QUALITY: ITS ROLE IN A MODERN, COMPETITIVE AMERICA

HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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QUALITY: ITS ROLE IN A MODERN, COMPETITIVE AMERICA

TUESDAY, APRIL 18, 1989

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY,
Washington, D.C.

The subcommittee met, pursuant to call, at 11:35 a.m., in room 2318, Rayburn House Office Building, Hon. Doug Walgren [chairman of the subcommittee] presiding.

Mr. WALGREN. Good morning, everybody.

This morning, the Subcommittee on Science, Research and Technology wants to focus on the role of quality in our economy and in America's economic future. It is no secret that many United States companies are not as competitive in world marketplaces as they have traditionally been in earlier years, and it is clear that that is not from a lack of creative ideas, and it is certainly clear it is not from a lack of products but, rather, from problems that we are experiencing in the quality of products made in the United States.

Not long ago, the label "Made in the U.S.A." was literally synonymous with the highest possible quality, and, at the same time, many foreign products were seen instinctively as products that were not of the quality that American consumers wanted to buy, and now, too often, the reverse of that is true.

During our hearing today, we want to discuss the legislation that established the National Quality Award as a way of focusing our attention and our efforts on the question of quality and as a way of taking the first steps to turn this situation around.

The Malcolm Baldrige National Quality Improvement Act of 1987 came out of this Subcommittee, and, as you know, it established an annual award to honor those companies who have achieved impressive gains and impressive performance in quality and quality improvement. Under the Act, awards are made each year to two qualifying companies, at maximum, in three different categories: manufacturing companies, service companies, and small businesses.

We have today representatives of the three 1988 award-winning companies to talk about their experience with the Malcolm Baldrige Quality Award and the efforts that have been made in their company that have been recognized as being extremely successful. We also have the Director of the Quality Award Program, along with the Treasurer of the Foundation which underwrites the Baldrige Award, as our first panel, and then a third panel of witnesses

from the business schools and other academic levels who are involved in trying to incorporate and respond to the needs of quality in their preparation of future business leaders and in their interaction with the present business community.

We hope that we can learn from our hearing today. Certainly this area is an area of fundamental importance and one that we want to do anything we can that would be helpful in pursuit of it.

With that for opening comments, I want to recognize the ranking minority member of the Subcommittee, Mr. Boehlert from New York.

Mr. BOEHLERT. Thank you, Mr. Chairman.

Today's gathering is as much a celebration as it is a hearing. We are honoring the achievements of the first three winners of the Malcolm Baldrige Quality Award and of the people who manage the exemplary selection process.

But this is a celebration with a moral. The words "Made in America" need not be viewed as a warning label, as the English translation of "caveat emptor." For too long, a cavalier attitude towards quality control has undermined American business both at home and abroad. The whole point of the Baldrige Award and of this hearing is to spread the gospel of quality control, a concept pioneered by Americans who were treated as prophets, save in their own land.

I hope our witnesses today will discuss the ways we can use this award to improve processes and products throughout American industry. Americans look for quality products; they should be able to buy them from domestic manufacturers.

I think a comment of John Glenn's brings home the point best. After the Mercury mission, he was asked what he had been thinking in the capsule while waiting for lift-off. Glenn responded, "I couldn't help but think, 'My God, this thing was built by the lowest bidder." Americans will pay more for quality. The Baldrige Award should help ensure that it is Americans that collect that premium.

With that, Mr. Chairman, I would also like to apologize. I have to take leave shortly for a few minutes to attend another meeting, and I will be back, because I am vitally interested in this subject, and I particularly want to pay tribute to those who have managed the selection process and those who are honored today.

Thank you.

Mr. WALGREN. Thank you, Mr. Boehlert.

Are there other opening comments that Members would like to make? Mr. Brown waives his rights. Mr. Ritter?

Mr. RITTER. Thank you, Mr. Chairman.

The quality revolution, Mr. Chairman, is sweeping America and the world. It is the third industrial revolution which gives people real power to use technology to its fullest. In the quality revolution, worker involvement, training, education, teamwork, and reward can lead to unprecedented mastery over the job to be done and satisfaction from doing it well. More and more, workers will become their own managers with automation or new technology expanding their power.

Quality puts less emphasis on direct cost cutting to increase profits and, instead, quality recognizes that improving the process by which a product is manufactured or a service delivered leads to

products or services which meet customers' needs and expectations. In short, perfecting the process perfects the product, a simple but stunning conclusion.

These days, we strive to make our products and services more competitive in the global economy, especially with those of Europe, Japan, and the Pacific Rim nations. But not enough Americans understand that American quality principles refined in Japan are the foundation of Japan's success, or that the prestigious Japanese quality award, the Deming Prize, is named after W. Edwards Deming, the American pioneer in the quality field.

Quality is a long-term commitment. The Japanese have spent almost 40 years achieving continuous improvement and better quality. VCR's, compact discs, Toyotas, and now HDTV's didn't happen by dumb luck in Japan. American quality principles played a large part in laying the foundation for those successes.

The Federal Government plays an important role in recognizing and promoting quality in America. The outstanding example of this is what we will hear about today, the Malcolm Baldrige National Quality Improvement Award, America's pinnacle of recognition of superior quality.

Eventually, I foresee the Baldrige Award rivaling the Nobel Prize in prestige and inspiration to all Americans to strive for superior quality. In former President Reagan's words, the Baldrige Award "offers companies a standard with which to compare their own progress to that of the country's very best."

The first three recipients deserve special commendation, and there will undoubtedly be more as the news spreads that quality works. Bob Galvin, the Chairman of Motorola, has stated that all suppliers to the Motorola Corporation will now be required to apply or to begin the process of application for the Malcolm Baldrige Award. John Akers, the Chairman of IBM, has recently said the same thing, even though IBM did not win a Baldrige Award as Motorola did. What that shows is an enormous ripple effect, a synergism, that starts to really improve our overall system.

Mr. Chairman, we have a resolution before the House, H.J. Res. 204, and that is for National Quality Month. Mr. Brown and I are two original cosponsors, and we hope to get 218 cosponsors before long and make sure that National Quality Month in October is celebrated with appropriate fanfare.

I thank you, Mr. Chairman, and I yield back.

Mr. WALGREN. Thank you, Mr. Ritter.

With that, we have an opening statement on behalf of Congressman Costello of Illinois which will be inserted in the record at this point.

[The prepared statement of Mr. Costello follows:]

OPENING STATEMENT
BY U.S. REP. JERRY COSTELLO
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
APRIL 18, 1989
"QUALITY IN MODERN AMERICA"

Mr. Chairman, I welcome this opportunity to address the topic of quality in America. In the 99th and 100th Congresses, committee efforts to improve quality in America focused on the passage of the Malcolm Baldrige National Quality Improvement Act, an award recognizing the most impressive quality achievements of U.S. companies.

Today we will introduce the winners of this award and express our appreciation at their commitment to quality in the workplace. As we face growing international competition and a need to reduce our trade deficit, we should focus on achieving with quality.

America's manufacturing symbol used to be a symbol of excellence, and we must restore that faith for American products again in the international market. Focusing on excellence and quality for American companies will help our country to achieve that goal.

I look forward to working with my colleagues on Congressional efforts to improve incentives for higher quality and greater standards of excellence for American businesses and products.

Mr. WALGREN. Our first panel today is made up of Curt Reimann—Dr. Reimann is the Associate Director for Quality Programs at the National Institute of Standards and Technology, joined by Larry Adams, who is the Treasurer of the Foundation for the Malcolm Baldrige National Quality Award coming out of Florida Power and Light, where he serves as Vice President of Finance, is it?

Mr. ADAMS. Economic development.

Mr. WALGREN. Well, you clarify the record. Let me welcome you both to the Committee.

As is our practice, written statements will be incorporated and produced for the record as you submit them, and you can feel free to focus on points or diverge from your written testimony to emphasize points that you would like to underscore in oral testimony. We appreciate your coming and look forward to the kinds of perspectives you can give us on this area.

We will start first with Dr. Reimann.

STATEMENTS OF DR. CURT REIMANN, ASSOCIATE DIRECTOR FOR QUALITY PROGRAMS, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, GAITHERSBURG, MARYLAND; AND LARRY H. ADAMS, TREASURER, THE FOUNDATION FOR THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD, MIAMI, FLORIDA

Dr. REIMANN. Mr. Chairman and members of the committee, I appreciate this opportunity to discuss the Malcolm Baldrige National Quality Award and its role in the national quality improvement initiative.

We are now in the midst of the second year of the award. The program already enjoys enormous credibility and has gained acceptance much more quickly than we thought possible when design of the program began in September 1987. Today, I would like to highlight the design and execution of the award program and conclude with some observations on its future.

In our design of the award program, we were mindful of the larger purposes Congress and the Administration set for the award, that the award be not only a basis for recognition but also an instrument in promoting quality awareness and information transfer. We set upon a course that we called Strategic Design, an integrated approach to pursue all aims of the program in parallel.

The most important elements in this design are three: one, an organizational approach to stimulate broad involvement and cooperation; two, a value system to project a clear vision and high standard of quality for all U.S. organizations; and, three, an evaluation system that ensures competence and integrity. These are also the key requirements to attract private funding.

In developing the program, NIST sought advice from scores of quality leaders and organizations. This served to foster wide involvement in, and ownership of, the new program. Following one of the cardinal principles of quality, NIST listened to its private sector customers.

The heart of the design of the award program is a seven-part examination that serves simultaneously as the basis for awards and as a device for information transfer, training, and self-assessment.

The examination sends a clear message of what it takes to be competitive.

Early in the program, we contacted hundreds of organizations, trade, professional, and many others, to help publicize the award. As for funding, Secretary Verity asked John Hudiburg, CEO of Florida Power and Light, and Sanford McDonnell, then-CEO of McDonnell Douglas, to lead the creation of a foundation. In less than one year, the foundation exceeded its target of $9.9 million, a remarkable achievement, indicative of commitment, fund-raising skill, and acceptance of the program.

Execution of the first year proceeded according to plan; 66 companies applied for awards; 45 in manufacturing, 12 in small business, and 9 in services; 13 companies were site visited. After an exhaustive and scrupulously fair review, the panel of judges recommended that Motorola and the Commercial Nuclear Fuel Division of Westinghouse receive awards in the manufacturing category and that Globe Metallurgical receive an award in the small business category. No awards were recommended in the service category. There were several very good service candidates, but the judges wished to establish a very high standard for the overall qualification award winners must have.

President Reagan presented the first awards in a ceremony at the White House on November 14, 1988. Following this ceremony, Secretary Verity hosted an award luncheon at the Commerce Department. These were truly memorable occasions for the winning companies and program contributors.

At the conclusion of the first year, the program received a thorough evaluation by the board of overseers. An excerpt from that board's report is: "The novel overall organization and financing that supports the process is most impressive, and the participants also. The review process is sound and secure, and the resulting award represents prestige and integrity."

All first year award applicants receive feedback reports. The reports focus on the applicant's strengths and areas for improvement in each of the seven evaluation categories. Based on the first year of the award program, there are several observations I would like to make.

First, many excellent U.S. companies applied. Applications in all three categories were better than expected. More applications were received from sectors more aggressive in disseminating award information. Many applicants, including those from the service sectors, have one or more gaps in their quality systems. The award examination achieved very rapid and widespread acceptance as a tool in self-assessment. We estimate that for every near-term applicant there are perhaps 50 to 100 organizations, including many not eligible for awards, using the award guidelines for a variety of purposes. The award-winning companies and program participants are contributing significantly to the awareness and information transfer campaigns.

As the program moves into the second year, information transfer becomes more important in planning. Key steps for 1989 and beyond include: The award examination has been improved and made more user friendly for service companies and small businesses. We have already distributed more than 20,000 applications,

about 5 times as many as had been distributed by April of last year.

Linkages between the award program and other communities, such as health care and business schools, are increasing. Conferences, workshops, case studies, and publications are well along, and many more are planned.

My overall assessment of the award program is very positive. The industry/Government cooperation, I believe, is working well. The program attracts excellent applicants and excellent evaluators. The award is helping to bring more cooperation to an area traditionally beset by considerable disagreement. Most importantly, the award is bringing to focus the quality requirements needed to compete in a global economy.

I urge all members of the committee to promote quality awareness in your districts and among your colleagues. I believe that the award is having the impact that its creators intended.

Thank you very much.

[The prepared statement of Dr. Reimann follows:]

U. S. DEPARTMENT OF COMMERCE

STATEMENT OF CURT REIMANN, ASSOCIATE DIRECTOR FOR QUALITY PROGRAMS

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

U. S. HOUSE OF REPRESENTATIVES

APRIL 18, 1989

Mr. Chairman and Members of the Committee:

I am Curt Reimann, Associate Director for Quality Programs. I appreciate the opportunity to appear before the Committee to discuss the Malcolm Baldrige National Quality Award and its role in the national quality improvement initiative launched with the passage of P.L. 100-107. We are now in the midst of the second year of the Award. The Program already enjoys enormous credibility and has gained acceptance much more quickly than we thought possible when design of the Program was begun in September, 1987. Today, I would like to highlight the design and execution of the Award Program, make some observations on the first one and one-half years, and conclude by outlining key Program plans.

In our design of the Award Program, we were mindful of the larger purposes Congress and the Administration set for the Award: that the Award be not only a basis for recognition but also an instrument in promoting quality awareness and information transfer. We set upon a course of what we call strategic design - an integrated approach to accomplish all the aims of the Program in parallel. The most important elements in this design are three: (1) creation of an organizational

approach to stimulate broad involvement and cooperation; (2) creation of a value system to project a clear vision of quality for all institutions, thus setting a standard that would challenge the best companies and attract the U.S.' leading quality experts; and (3) creation of an evaluation system that would ensure competence and integrity. It was our view that all three of these requirements would have to be met to attract private funding needed for the Award.

In developing the Award examination and evaluation system, NIST sought the advice of scores of quality leaders and organizations. We produced draft criteria, evaluation schemes, and training curricula, circulated them for comment and held meetings to revise and improve them. This approach served to foster wide involvement in and "ownership" of the new Program. Following one of the cardinal practices of quality, NIST listened to its private sector customers.

The heart of the design of the Award Program is a seven-part examination that serves simultaneously as the basis for Awards and as a device for information transfer, training, and self assessment. Self assessment is the key here. We moved in this direction because so many quality experts had emphasized that too many U.S. businesses do not have a good understanding of the quality requirements necessary to compete in international markets. Self assessment would thus serve a major role in the awareness effort.

Early in the Program, we contacted hundreds of organizations - trade, professional, and business associations, states, members of Congress and

many others - to help publicize the Award. Publicity was a major focus owing to the newness of the Award and the rapid pace of implementation the Administration had set for it.

As for funding, Secretary Verity asked John Hudiburg, CEO of the Florida Power and Light Company (FPL) and Sanford McDonnell, then CEO of McDonnell Douglas Corporation (MDC) to lead the creation of a foundation to support the Award. Accepting the challenge, Hudiburg and McDonnell with the able and enthusiastic support of Larry Adams (FPL) and Don Malvern (MDC) solicited the involvement of many of the U.S.' most quality conscious and influential leaders to serve as Foundation Trustees. In less than one year the Foundation exceeded its target of $9.9M - a remarkable achievement, indicative of commitment, fund raising skill, and acceptance of the Program.

Execution of the first year proceeded according to the plan devised in the fall of 1987. One hundred of the U.S.' leading quality experts were selected from more than 200 excellent applicants to serve on the first Board of Examiners. I wish to note here that many of the Examiner applicants were people who had been contacted for advice early in the Program. With the strong support from Commerce Secretary Verity, the Florida Power and Light Company, the American Society for Quality Control, and the American Productivity and Quality Center, Award criteria, evaluation system and training program were developed and refined. Particularly helpful at this point was the assignment by FPL of a loaned executive, Alan Siebe, to NIST.

In 1988, 66 companies applied for Awards - 45 in manufacturing, 12 in small business and 9 in services. Thirteen companies were site visited. After an exhaustive and scrupulously fair review, the Panel of Judges, headed by William Eggleston, recommended that Motorola, Inc., and the Commercial Nuclear Fuel Division of Westinghouse Electric Corporation receive awards in the manufacturing category and that Globe Metallurgical, Inc., receive an award in the small business category. No Awards were recommended in the service category. There were several very good service company candidates, but the Judges and the Commerce Department wished to establish a very high standard regarding the overall qualifications an Award winner must have.

President Reagan presented the first Awards in a ceremony at the White House on November 14, 1988. Following this ceremony, Secretary Verity hosted an Award luncheon at the Commerce Department. The Award ceremony and luncheon were truly memorable occasions for the winning companies and Program contributors, thus establishing a positive precedent for the future of the Award.

At the conclusion of the first year, the Program received a thorough evaluation by the Board of Overseers. To facilitate this evaluation, NIST prepared a report to the Overseers on the first year's program. The evaluation comprised a review of the Award criteria and processes, plans, and information transfer, and included a report by William Eggleston, Chairman of the Judges Panel. Based upon its evaluation, the Board of Overseers gave a strong positive endorsement of the Program and NIST's plans for 1989. Excerpts from the Overseers Report are:

"The novel overall organization and financing that supports the process is most impressive --- and the participants also. The review process is sound and secure --- and the resulting award represents Prestige and Integrity. And so the Foundation; Board of Examiners; Contractor; Affiliated Organizations --- and the Overseers --- are all to be commended for First Class performances!"

"We Overseers find no major flaws with what has been done --- and this, of itself, is remarkable. We carefully reviewed, for example, aspects of cost and confidentiality --- and the absence of a Service Awardee. And we are tremendously impressed by your built-in process of continuing improvements for the future --- a key characteristic of Quality-related endeavors."

All first year applicants received feedback reports. The reports included information on an applicant's overall score in relation to all scores, how the process was conducted, the applicants strengths and areas for improvement in each of the seven evaluation categories. Feedback reports proved to be the most demanding task owing to the need to harmonize the comments of several Examiners who work in different locations in the U.S. In addition, most Examiners had already given 12 to 20 days to the program, often at great sacrifice.

Based upon the first year of the Award Program there are several observations I would like to make:

(1) many excellent U.S. companies applied. Applications in all three categories were better than expected. Many of the applicants are making progress at a rapid pace.

(2) because the Award emerged so quickly, more applications were received from sectors which were more aggressive in disseminating information about the Award. We believe that as the Award becomes better known, we will receive more applicants from the service and small business sectors.

(3) many applicants including those from the service sector have one or more gaps in their quality systems. Feedback to the applicants pointed out these gaps.

(4) the Award examination achieved very rapid acceptance as a tool in self assessment and training in manufacturing and service businesses, government and hospitals. We estimate that for every near-term applicant there are perhaps 50 to 100 organizations using the Award guidelines for some other purpose.

(5) interest in the Award Program has grown rapidly. Many companies plan to apply but some wish to refine their quality systems over 1 to 5 years before doing so.

(6) the Program is able to attract top quality leaders despite the large effort necessary to participate. Each application required more than 120 hours of review to ensure reliability in scoring and competent feedback. The Board of Examiners expended enormous effort and performed admirably in the first year of the Award.

(7) the industry-government cooperation worked smoothly. The number of volunteers is already more than 200. These volunteers include experts providing time to write case studies, draft feedback reports, revise guidelines, speak about the program to a variety of audiences, and promote the Award.

(8) the Award winning companies are contributing significantly to the awareness and information transfer campaigns through their participation in conferences and workshops, their hosting of numerous visitors, and their advertising campaigns.

As the Program moves into the second year and gains ever wider acceptance, the information transfer aspects of the Program become more important in planning. Key steps for 1989 and beyond include:

- the Award examination has been improved and made more "user friendly" for service companies and small businesses. As a result of these changes, the examination is being used more widely as a self-assessment tool. Many efforts are underway to promote the widespread use of the examination in various communities. We have already distributed more than 20,000

applications, about five times as many as had been distributed by April of last year.

- linkages between the Award Program and other communities such as health care and business schools are increasing. This is being accomplished through seeking out leaders from these communities to serve in the Board of Overseers and the Board of Examiners.

- efforts are underway to assist state and local organizations who wish to establish quality awards. Our intent is to help harmonize efforts so that businesses throughout the U.S. are not subjected to conflicting values. Also, we will be seeking input from state and local organizations on how we may improve the Award and our services.

- conferences, workshops, case studies, and other publications are well along and many more are planned.

- the Board of Examiners has been expanded to 135 in anticipation of more applicants. New appointments also bring many new organizations into the Program, a key step in information transfer.

My overall assessment of the acceptance of the Award Program at this point is a very positive one. Industry interest, involvement, and support are growing rapidly. The industry-government cooperation envisioned in the creation of the Award is working well. The Program

attracts excellent applicants and excellent evaluators. Rapid adoption of the Award examination as a tool in self-assessment, training, and communications is helping to bring more cooperation to an area traditionally beset by considerable disagreement. More importantly, the Award is serving as a value system for the quality requirements needed to compete in a global economy in the future. I urge all members of the Committee to promote quality awareness in their districts and to encourage applications for Awards. The best first step is to encourage the use of the Award guidelines in self assessment.

I believe that the Award is having the impact that its creators intended.

Biographical Sketch
Curt W. Reimann

Dr. Curt W. Reimann is Associate Director for Quality Programs at the National Institute of Standards and Technology (NIST) and Director of the Malcolm Baldrige National Quality Award. The Malcolm Baldrige National Quality Award, created by Public Law 100-107, was established to promote quality awareness, recognize excellent U.S. companies, and publicize successful quality strategies. A private sector Foundation has been set up to raise funds for the public/private cooperative Award Program.

Prior to his current assignment, Dr. Reimann served as Deputy Director of the National Measurement Laboratory, the NIST organization responsible for developing and maintaining the Nation's basic physical, chemical, and radiation measurements and standards. Earlier, Dr. Reimann served as Director of the NIST Center for Analytical Chemistry. This Center develops chemical measurements and standards for ensuring the reliability of measurements made in manufacturing, clinical testing, environmental monitoring, and research and development.

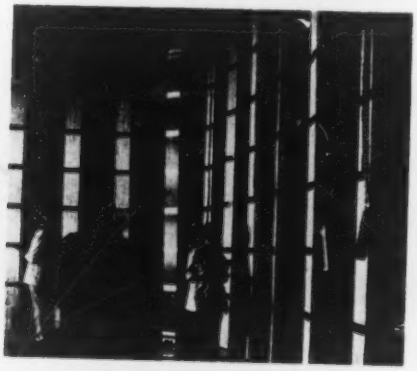
Dr. Reimann began his career at NIST in 1962 as a research chemist specializing in structural and spectroscopic properties of complex metal organic systems. Concurrent with his research activities, he was Adjunct Professor of Chemistry at the University of Maryland for three years. Dr. Reimann received his B.A. in Chemistry from Drew University and a Ph.D. from the University of Michigan. After completing his doctoral work, he was a NSF-NRC Postdoctoral Fellow at Yale University. Dr. Reimann has been active in professional organizations, including the American Society for Quality Control, the Instrument Society of America, the American Chemical Society, and the Council for Chemical Research.

Malcolm Baldrige National Quality Award

1988 AWARD WINNER

COMMERCIAL NUCLEAR FUEL DIVISION WESTINGHOUSE ELECTRIC CORPORATION

When electric utilities operating nuclear power plants install fuel-rod assemblies made by the Westinghouse Commercial Nuclear Fuel Division (CNFD), they can be 99.995 percent certain that each of the thousands of rods supplied will perform flawlessly. Realizing that future business depends on continued excellence in product performance, CNFD is pushing its all-important



dependability rating even higher.

Prior to the early 1980's, the CNFD quality goals were geared toward satisfying regulatory requirements for fuel-rod assemblies. Then, motivated by stiff competition and demanding customer requirements, it raised its sights with the objective of being recognized as the world's highest-quality supplier of commercial nuclear fuel.

The Commercial Nuclear Fuel Division of Westinghouse is building a quality culture that asks employees to do "the right things right the first time." This philosophy makes every action by every employee a quality initiative. Customer satisfaction is the guiding principle, whether it is the ultimate customer or the next person in the process.

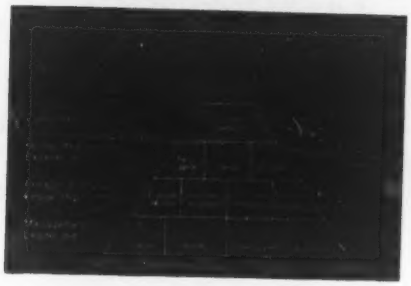
CNFD uses a "Total Quality" approach built upon four imperatives for continuous quality improvement: management leadership, product and process leadership, human resource excellence, and customer satisfaction. Progress is measured by a unique system called "Pulse Points." The system tracks improvements in over 60 key performance areas identified with statistical techniques and other evaluative tools, and it helps set measurable goals within each unit of CNFD, down to the jobs of hourly workers.

Product and service improvements attributable to the seven-year old program have paid business dividends. The value of new orders in 1987 was the highest in the decade.

CNFD AT A GLANCE

Begun in 1969 and now part of the Westinghouse Nuclear Fuel Business Unit, one of 26 such units in the company, CNFD currently employs nearly 2,000 people at three sites. The Specialty Metals Plant, near Pittsburgh, produces the zircalloy tubes that encase pellets of uranium dioxide fuel processed at CNFD's Columbia, South Carolina plant. Final fabrication of fuel-rod assemblies is also done at the Columbia Plant. Headquarters Operations and Nuclear Engineering activities are located in Monroeville, Pennsylvania.

The CNFD currently supplies about 40 percent of the U.S. market for fuel-rod assemblies and about 20 percent of the world market. Fuel assemblies supplied by the Columbia Plant accounted for nearly seven percent of U.S. electrical needs in 1987.



"Total Quality"

CNFD uses state-of-the-art technology, such as robotics and other automated processing equipment, supercomputer simulations, expert systems and laser-diagnostics, and laser welding. It estimates that quality-related decisions have dictated 75 percent of its capital allocations during recent years. Management, however, attributes CNFD's substantial improvements in quality and efficiency not so much to advanced technology as it does to a "turned on" work force and to CNFD's Total Quality approach to operations.

Rather than having a chief quality officer, CNFD assigns responsibility for directing and coordinating quality improvements to the general manager and his various staff functions. These managers form the CNFD's Quality Council, which sets policies, plans and strategies, and directs the quality improvement process. Management's rationale is that quality concerns must be fully integrated into all design, production, and customer service activities.

In strategic planning, top management develops formal quality initiatives and Pulse Points that are deemed most critical to improving performance and customer satisfaction. Supporting, measurable goals, all aimed at accomplishing divisional objectives, are developed in each of the departments and then for each worker. Progress is monitored through an extensive data-collection and trend-analysis system. Pulse Point trends are reviewed each month in a teleconference that includes top management at each division site.

Workers directly address quality improvement opportunities and help devise initiatives through their participation in project-oriented teams. Nearly 1,400 employees were members of 175 such teams in 1987. About 90 percent of all workers have undergone quality awareness or quality-related training during the past three years.

CNFD maintains close — usually daily — contact with its utility customers and regularly collects technical data to evaluate the performance of its fuel assemblies. Customer service plans are created for each client and are jointly reviewed each quarter. A customer's Fuel Users Group meets twice a year to share information and discuss needs for new products. Consistently high scores in surveys and customer-conducted audits reflect high levels of satisfaction. A more telling indicator, however, is repeat business. Existing customers accounted for more than 90 percent of the orders placed in 1987.

Although its eye is on the bottom line, CNFD management deliberately did not include cost concerns in its quality improvement program, believing that gains in quality would spawn cost-reductions through increases in efficiency. Results achieved between 1984 and 1987 confirm this belief. For example, first time through yields in the manufacture of fuel rods increased from less than 50 percent to 87 percent, substantially reducing scrap, product reworking, and manufacturing cycle time. This helped CNFD achieve over three years of 100 percent on-time delivery of high-quality products.

For more information contact:
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Commercial Nuclear Fuel Division
Westinghouse Electric Corporation
P.O. Box 3912
Pittsburgh, PA 15230-3912

Malcolm Baldrige National Quality Award

1988 AWARD WINNER

MOTOROLA INC.

Like an olympic athlete seeking to score better than determined world rivals, Motorola Inc. seeks sales victories in world markets for electronic components and equipment by improving the quality of its own performance. For Motorola, quality improvement leading to total customer satisfaction is the key.

In 1981, Motorola launched an ambitious drive for a tenfold improvement in the quality of its products and services. Motorola succeeded. Now, the company has evidence that many of its products are the best in their class. Looking ahead, Motorola intends to top its achievements — further gains in quality for 1989, yet another leap in 1991, and near perfection a year later. The company's quality goal is simply stated: "Zero defects in everything we do."

Motorola's managers literally carry with them the corporate objective of "total customer satisfaction." It's on a printed card in their pockets. Corporate officials and business managers wear pagers to make themselves available to customers, and they regularly visit customers' businesses to find out their likes and dislikes about Motorola products and services. The information, along with data gathered through an extensive network of customer surveys, complaint hotlines, field audits, and other customer feedback measures, guides planning for quality improvement and product development.

COMPANY AT A GLANCE

Employing 99,000 workers at 53 major facilities worldwide and based in Schaumburg, Illinois, 60-year old Motorola is an integrated company that produces an array of products, distributing most through direct sales and service operations. Communication systems — primarily two-way radios and pagers — account for 36 percent of annual sales, and semiconductors account for 32 percent. The remaining revenues come from sales of cellular telephones and equipment for defense and aerospace applications, data communications, information processing, and automotive and industrial uses. Sales in 1987 totalled $6.7 billion.

Responding to the rapid rise of Japanese firms in world markets for electronics, Motorola's management began an almost evangelical crusade for quality improvement; addressing it as a company issue and, through speeches and full-page ads in major publications, as a national issue.

The company's most persuasive messages, however, are the results of its quest for quality. Most products have increased their market share, here and abroad. In Japan, for example, Motorola pagers, supplied to Nippon Telephone and Telegraph, were introduced in 1982 and now claim a major share of that market. Over the past two years alone, Motorola has received

nearly 50 quality awards and certified supplier citations, tops among the 600 electronics firms responding to a survey published in March 1987.

Key Quality Initiatives

To accomplish its quality and total customer satisfaction goals, Motorola concentrates on several key operational initiatives. At the top of the list is "Six Sigma Quality," a statistical measure of variation from a desired result. In concrete terms, Six Sigma translates into a target of no more than 3.4 defects per million products, customer services included. At the manufacturing end, this requires designs that accommodate reasonable variation in component parts but production processes that yield consistently uniform final products. Motorola employees record the defects

found in every function of the business, and statistical technologies are increasingly made a part of each and every employee's job.

Reducing the "total cycle time" — the time from when a Motorola customer places an order until it is delivered — is another vital part of the company's quality initiatives. In fact, in the case of new products, Motorola's cycle-time reduction is even more ambitious; the clock starts ticking the moment the product is conceived. This calls for an examination of the total system, including design, manufacturing, marketing, and administration.

Motorola management demonstrates its quality leadership in a variety of ways, including top-level meetings to review quality programs with results passed on through the organization. But all levels of the company are involved. Nonexecutive employees contribute directly through Motorola's Participative Management Program (PMP). Composed of employees who work in the same area or are assigned to achieve a specific aim, PMP teams meet often to assess progress toward meeting quality goals, identify new initiatives, and work on problems. To reward high-quality work, savings that stem from team recommendations are shared. PMP bonuses over the past four years have averaged about 3 percent of Motorola's payroll.

To ensure that employees have the skills necessary to achieve company objectives, Motorola has set up its own training center and spent in excess of $170 million on worker education between 1983 and 1987. About 40 percent of the worker training the company provided last year was devoted to quality matters, ranging from general principles of quality improvement to designing for manufacturability.

Motorola knows what levels of quality its products must achieve to top its competitors. Each of the firm's six major groups and sectors have "benchmarking" programs that analyze all aspects of a competitor's products to assess their manufacturability, reliability, manufacturing cost, and performance. Motorola has measured the products of some 125 companies against its own standards, verifying that many Motorola products rank as best in their class.

MOTOROLA INC.

For more information contact:
Jack Germain
Senior Vice President and
Director of Quality
Motorola Inc.
1303 East Algonquin Road
Schaumburg, IL 60196

Malcolm Baldrige National Quality Award

1988 AWARD WINNER

GLOBE METALLURGICAL INC.

In a tailspin like most other firms in the nation's "smokestack industries," Globe Metallurgical Inc. refused to retreat from the rising tide of imported cheap, commodity-grade metals. While

many U.S. makers of ferroalloys (iron-based metals) were closing plants, the Ohio-based company stated its refusal in the most convincing of terms. It initiated a quality-improvement program that has made its products the standards of excellence in the metals industry.

Globe set out in 1985 to become the lowest-cost, highest-quality producer of ferroalloys and silicon metal in the United States. At the same time, the firm shifted its focus from commodity markets, such as steel manufacturing, to the higher value-added markets represented by the foundry and chemical industries and certain segments of the aluminum industry.

Three years later, Globe occupies a quality niche above the competition. Not coincidentally, its share of the U.S. market for high-quality foundry alloys has risen dramatically, sales in Canada and Europe have increased significantly, and profitability has returned.

In quality audits by General Motors, Ford, Intermet, John Deere, and other customers, the firm's scores have set records, resulting in certified supplier status for Globe. Foreign buyers also recognize Globe's commitment to quality. When many European traders place an order for magnesium ferrosilicon alloy they specify that the material must be "Globe quality," a standard that other suppliers must match.

COMPANY HISTORY

A privately held company since 1987, when Moore McCormick Resources sold all of its metal-related businesses, Globe employs 210 people at plants in Beverly, Ohio, and Selma, Alabama. The plants produce about 100,000 tons of alloys annually for more than 300 customers. Annual sales totalled less than $100 million in 1987, but are projected to increase by approximately 30 percent in 1988.

The firm's drive for quality began two years before the leveraged buy out of Globe's current management. In 1985, Globe's managerial staff was trained in statistical process control and, by the year's end, the foundation of a company-wide quality-improvement system — termed Quality, Efficiency, and Cost (QEC) — was laid.

ELEMENTS OF QEC

Globe's QEC program permeates the entire company, and goals for quality improvement are integrated into strategic planning and research and development activities. Quality committees exist at every level within the company, and rapid communication scales the distance between top officials, who make up Globe's QEC steering committee, and workers, who participate in "quality circles" that meet weekly. In between in each plant is the QEC committee, composed of the plant manager and department heads, that assembles each morning to review the previous day's performance.

The QEC committee assesses the causes of out of control conditions, reviews corrective measures, evaluates suggestions made by quality circles, and addresses broader quality issues that might be raised by the steering committee.

Now three years into its QEC program, Globe has found no surfeit of good ideas for improving product quality and reducing cost, many of them originating with workers. Improvement measures are carefully tracked, and the results — successes and failures — are published monthly.

In fact, Globe attempts to monitor and quantify every factor that influences product quality, making extensive use of computer-controlled systems that continually advise workers on whether target values for important processing variables are being met. Key variables are identified through a number of means, including failure mode effects analyses, statistical evaluations that identify production steps that are most prone to failure. Color control charts derived from a system developed in-house document each product's processing history. The charts provide workers, who are trained in statistical process control, with a performance appraisal and customers with important information for their manufacturing processes.

Significant improvements in achieving the targeted grade of metal have been realized since the implementation of the computer-controlled systems, with corresponding reductions in the amount of scrap or reclassified product produced. Today, only about 3 percent of the heats — including initial batches of new products — require reclassification. Similarly, greater consistency in final products, achieving specifications that fall within ranges more demanding than those imposed by customers, has significantly lowered the chance of an out-of-specification shipment. The improved consistency of the operation has increased the production rates on the furnaces, while significantly reducing energy consumption, a major cost item for Globe. At the same time Globe has realized improvements in manpower efficiency of over 50% in certain areas.

Customer complaints have decreased by 91 percent, from 44 in 1985, when 49,000 pounds of product were returned for replacement, to 4 in 1987, when no product was returned.

Among workers, who have flexible job assignments and whose quality-improvement efforts are recognized through personal letters from management and small gifts, Globe's QEC program is paying dividends. The accident rate, near the average for the ferroalloy industry in 1985, has fallen, while the industry average has risen. The Globe absenteeism rate has also decreased since 1985.

For more information contact:
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Globe Metallurgical Inc.
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Beverly, OH 45715

The Foundation for the Malcolm Baldrige National Quality Award

The Malcolm Baldrige National Quality Improvement Act of 1987 was signed by President Reagan on August 20, 1987. The Act establishes an annual U.S. National Quality Award. Its purpose is to promote quality awareness and to publicize successful quality strategies. The Secretary of Commerce and the National Institute of Standards and Technology (formerly, the National Bureau of Standards) provide the leadership and management and the private sector provides the administration, the examiners, oversight, and funding of the Award Program.

The Foundation for the Malcolm Baldrige National Quality Award was created to provide the private sector a means of accomplishing the following Award objectives: raise sufficient funds to establish an endowment which, when supplemented by fees from Award applicants, will permanently fund the Award Program; oversee the investment of endowment funds; review Award Program accomplishments and disburse required funds to the National Institute; and review the plans and approve associated funds requirements for subsequent years to assure a successful Awards Program.

Leaders of prominent companies have been selected to serve as Foundation Trustees to assure the objectives of the Foundation in supporting the Award Program are accomplished. In addition, a broad cross-section of companies across the U.S. are contributing to the Foundation. Included are lists of the Foundation's Trustees, Officers and of the companies which are providing financial support to the Foundation.

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Malcolm Baldrige National Quality Award

FACT SHEET

Public Law 100-107, the Malcolm Baldrige National Quality Improvement Act of 1987, signed by President Reagan on August 20, 1987, establishes an annual U.S. National Quality Award. The purposes of the Award are to promote quality awareness, recognize quality achievements of U.S. companies, and to publicize successful quality strategies. The Secretary of Commerce and the National Institute of Standards and Technology (formerly the National Bureau of Standards) are given responsibilities to develop and administer the Awards with cooperation and financial support from the private sector.

THE AWARDS

Up to two Awards may be given each year in each of three categories:

- o manufacturing companies or subsidiaries
- o service companies or subsidiaries
- o small businesses

Fewer than two Awards may be given in a category if the high standards of the Award Program are not met. The first awards were presented by President Reagan on November 14, 1988 to Motorola Inc., Commercial Nuclear Fuel Division of Westinghouse Electric Corporation, and Globe Metallurgical Inc. Recipients receive a medal in a crystal base. They may publicize and advertise their Awards, provided they agree to share with other American organizations information about their successful quality strategies.

ELIGIBILITY

Businesses incorporated and located in the U.S. may apply for Awards. Subsidiaries are defined as divisions or business units of larger companies. Subsidiaries must primarily serve either the public or businesses other than the parent company. For companies engaged in both services and manufacturing, classification is determined by the larger percentage of sales. Small businesses are independently owned with not more than 500 full-time employees.

AWARD CRITERIA

Seven (7) areas are examined: (1) leadership; (2) information and analysis; (3) planning; (4) human resource utilization; (5) quality assurance of products and services; (6) quality results; and (7) customer satisfaction. Applicants must address a set of examination items within each of these categories. Heavy emphasis is placed on quality achievement and quality improvement as demonstrated through quantitative data furnished by applicants.

EXAMINATION PROCESS

Each written application is reviewed by at lease three examiners. High-scoring applicants are selected for site visits by one or more teams of examiners. Award recipients will be chosen from among the applicants site visited. A panel of judges reviews all data and information and recommends Award recipients. Applicants receive a written feedback summary of strengths and areas for improvement in their quality management. The Malcolm Baldrige National Quality Award Consortium, formed by the American Society for Quality Control and the American Productivity and Quality Center, administers the examination process.

EXAMINERS

The Board of Examiners is comprised of quality experts, selected from industry, professional and trade organizations and universities. Those selected meet the highest standards of qualification and peer recognition. Examiners must take part in a preparation program based upon the criteria, the scoring system, and the examination process. Each year applications are solicited in October and November for quality experts to serve as examiners for the following year.

TIMETABLE

Award applications available	January 10, 1989
Applications due	May 5, 1989
Application review/site visits	May 5 - September 30, 1989
Award Ceremony	November 1989

CONFIDENTIALITY

All applications are confidential. Applicants are not expected to provide proprietary information regarding products or processes. Examiners are assigned in such a way as to avoid conflicts of interest. All examiners must sign nondisclosure agreements. Information regarding successful strategies of Award recipients is released only after written approval.

FEES

Fees are set to cover some of the costs of review. A fee of $2000 is charged for review of the basic written examination for the manufacturing and service categories. A fee of $1200 is charged for the small business category. More detailed written examinations--required of organizations which need to describe multi-business or multi-product quality systems--result in proportionately higher fees. Separate site visit fees are set at the time site visits are scheduled.

For applications or additonal information, write or call:

Malcolm Baldrige National Quality Award
National Institute of Standards and Technology
Gaithersburg, Maryland 20899
(301) 975-2036

2/89

Application Guidelines 1989

Malcolm Baldrige
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Award

"Quality is the key to making American products. We are in the midst of a technological revolution, and our work to build quality products will be a crucial link to the long-term success of the United States in the global marketplace."

George Bush

"The President has called for our economic system to put an increased emphasis on quality. Let's make it our goal to achieve quality from top management to the beginning employee."

Robert A. Mosbacher,
Secretary of Commerce

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THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD

INTRODUCTION

The Malcolm Baldrige National Quality Improvement Act of 1987, Public Law 100-107, signed by President Reagan on August 20, 1987, establishes an annual United States National Quality Award. The purposes of the Award are to promote quality awareness, to recognize quality achievements of U.S. companies, and to publicize successful quality strategies.

The Award:

- formally recognizes companies that attain preeminent quality leadership, and permits these companies to publicize and advertise receipt of their Awards,
- encourages other companies to improve their quality management practices in order to more effectively compete for future Awards,
- develops and publishes Award criteria that will also serve as quality improvement guidelines for use by U.S. companies, and
- widely disseminates non-proprietary information about the quality strategies of the Award recipients.

This document is a guide for Award applicants. It outlines the the following: the Award processes and requirements; the eligibility categories and restrictions; the fee schedule; and the Examination. An Application Form and a form for listing and describing facilities are included along with related instructions.

AWARD PROCESSES AND REQUIREMENTS -- SUMMARY

THE AWARDS

Awards will be presented in November 1989. Award recipients receive a medal contained in a crystal base. The medal bears the inscriptions "Malcolm Baldrige National Quality Award" and "The Quest for Excellence." Recipients may publicize and advertise receipt of their Award, provided they agree to share with other American organizations information about their successful quality strategies.

TIMETABLE

Applications/guidelines available	January 10, 1989
Applications due	May 5, 1989
Applications review/site visits	May 5 - September 30, 1989
Award Ceremony	November 1989

AWARD CATEGORIES

Up to two Awards may be given each year in each of three categories: (1) manufacturing companies or subsidiaries; (2) service companies or subsidiaries; and (3) small businesses. Fewer than two Awards may be given in a category if the high standards of the Award Program are not met. Businesses incorporated and located in the United States may apply for the Award. Subsidiaries—divisions or business units of larger companies—are eligible if they primarily serve either the public or businesses other than the parent company. For companies engaged in both services and manufacturing, classification is determined by the larger percentage of sales. For purposes of the 1989 Awards, small businesses are defined as independently-owned businesses with not more than 500 full-time employees. Further information and restrictions on eligibility are detailed on page 4.

APPLICATIONS

The application consists of: (1) an Application Form for providing basic information about the company; (2) a Site Listing and Descriptors Form for providing information about the company's locations and functions performed; and (3) an Application Report addressing a set of 44 examination items.

For the manufacturing and service categories, the Application Report must be no longer than 75 pages. However, Supplemental Sections may be required for some applicants. Instructions concerning the Application Report can be found on page 14. For the small business category, the Application Report must be no longer than 50 pages; no Supplemental Sections are allowed.

BOARD OF EXAMINERS

A Board of Examiners reviews and evaluates all applications. The Board is comprised of more than 100 quality experts selected from industry, professional and trade organizations, and universities. Those selected meet the highest standards of qualification and peer recognition. Examiners take part in a preparation course based upon the examination items, the scoring criteria, and the examination process.

EXAMINATION PROCESS

Each application is reviewed by at least four members of the Board of Examiners. High-scoring applicants are selected for site visits to be made by one or more teams of Examiners. A panel of nine Judges from the Board of Examiners reviews all data and information and recommends Award recipients. The Judges' Award recommendations are based not only upon scores applicants receive on the written examination but also upon the Judges' assessment of overall strengths and areas for improvement as determined from site visits. The recommendations of the Judges is final and not subject to appeal. All applicants receive a written feedback summary of strengths and areas for improvement relative to the award examination categories.

SITE VISITS

The highest scoring candidates for the Award will undergo site visits by members of the Board of Examiners. The primary objectives of the site visits are to verify the information provided in the Application Report and to clarify issues and questions raised during review of the Report. A site visit agenda is provided to the company at least two weeks in advance of the visit. The site visit agenda includes, but is not limited to, a schedule of planned visits to the applicant's facilities and operating units, a list of corporate officials to be interviewed, an estimate of time requirements for the visits, and the names of Examiners scheduled to participate. During site visits, presentations are made by applicants, interviews are conducted by the Examiner teams and pertinent records and data are reviewed.

The number of Examiner team members and the time required for site visits varies according to the complexity of the Award application and the number of sites to be visited. Sampling methods and recommendations from the Examiners are used to determine the number of sites to be visited. Most visits last 2-3 days. Reports of findings are developed by site visit teams for submission to the Judges. During site visits, applicants may be asked to provide data for inclusion in this report. Additional information or data will not be accepted from the applicant once site visits are completed, unless specifically requested by the Board of Examiners. Applicants selected for site visits will be asked to authorize review of their tax status regarding filing of tax returns, payment of taxes, and absence of criminal offenses and fraud. The information is required to ensure suitability of the applicant as a national award winner.

CONFIDENTIALITY

All applications are treated as confidential. Applicants are not expected to provide or to reveal proprietary information regarding products, processes, or services. Examiners are assigned in such a way as to avoid conflicts of interest. All Examiners sign nondisclosure agreements. Information regarding successful strategies of Award recipients may be released only after written approval from recipients.

FEES

The Award Program is administered without funding from the United States government. All expenses are paid from application fees and from funds from The Foundation for the Malcolm Baldrige National Quality Award. The Foundation has been established to accept donations and to manage the funds. Fees are charged to cover most costs associated with the examination and judging processes. The following fees are in effect for 1989 applications:

a. Basic Report - $2000 for the manufacturing and the service categories; $1200 for the small business category.

b.Supplemental Section - $1200 each (See Application Report Guidelines, page 16, for details on when it may be necessary to prepare Supplemental Sections.)

Fees must be paid at the time the application is submitted. All fees should be paid by check or money order payable to: The Malcolm Baldrige National Quality Award. Fees will be refunded if it is deemed that the application is incomplete or that the applicant is ineligible.

Site visit fees will be set when the visits are scheduled. Fees depend upon the number of sites to be visited, the size of the team required and the number of days the visits are conducted. Fees will cover the expenses of the site visit teams.

CHANGES FROM THE 1988 REQUIREMENTS

Several changes have been made from the 1988 application requirements. The fees have been changed—increasing in the case of the manufacturing and the service categories and decreasing in the case of small businesses. The maximum number of pages for the small business category has changed to 50 pages. There is no longer a lower limit on the number of employees to be eligible for the small business category. The definition of an eligible subsidiary now includes a requirement of a minimum of 500 employees *or* 20% of the domestic employees of the parent company. Changes in the Examination are described on page 15.

AWARD ADMINISTRATION

The Award Program is managed by the National Institute of Standards and Technology (formerly the National Bureau of Standards), United States Department of Commerce. The Program is administered by The Malcolm Baldrige National Quality Award Consortium, Inc.—a joint effort of the American Society for Quality Control and the American Productivity and Quality Center.

For additional information concerning the Award, contact the Award Office.

Malcolm Baldrige National Quality Award
National Institute of Standards and Technology
Gaithersburg, MD 20899
Tel. (301) 975-2036

Additional copies of the application material may be obtained from the Award Office or from the Administrator, Malcolm Baldrige National Quality Award, P.O. Box 443, Milwaukee, WI 53201-0443, Tel. (414) 272-8575.

ELIGIBILITY — CATEGORIES AND RESTRICTIONS

INTRODUCTION

Eligibility categories for Awards—manufacturing, service, and small business - are given in Public Law 100-107. Specific requirements and definitions pertaining to these categories are described below under Basic Eligibility. Some companies, eligible under these Basic Eligibility criteria, are not eligible if the nature of their activities is such that the central purposes and requirements of Public Law 100-107 cannot be fulfilled through their participation. Such cases are outlined below under the heading Restrictions on Eligibility.

BASIC ELIGIBILITY

Publicly- or privately-owned businesses incorporated and located in the United States may apply for Awards. State, local, and national government agencies, not-for-profit organizations, trade associations and professional societies are not eligible.

AWARD CATEGORIES

1. Manufacturing Companies and Producers

Companies or subsidiaries that produce and sell manufactured products or manufacturing processes and those companies which produce agricultural, mining, or construction products (SIC Codes 01-39)

2. Service Companies

Companies or subsidiaries that sell services (SIC Codes 40-89).*(Classification of companies that perform both manufacturing and services is determined by the larger percentage of sales.)*

3. Small Businesses

Independently-owned businesses with not more than 500 full-time employees. Business activities may include manufacturing, and/or service.

SUBSIDIARIES

Subsidiaries are defined as business units or divisions of companies. To be eligible, business units or divisions must have existed prior to the Award application and must have a clear definition as reflected in corporate literature such as organization charts, administrative manuals, or annual reports. A subsidiary must have no fewer than 500 full-time employees *or* at least 20% of all employees in the domestic operations of the company to be eligible. In addition, a subsidiary of a company which has more than 500 employees is not eligible for an Award under the small business category even if the subsidiary has fewer than 500 employees. Subsidiaries of small businesses are not eligible for an Award; small businesses must apply as a whole.

The application of a subsidiary must describe the quality systems for the full range of activities of a complete enterprise. Typical activities include: marketing, purchasing, legal services, human resources, sales and distribution, finance and accounting, product engineering and research and development. In some cases, the applying unit may depend upon other company units or the corporate level for one or more of these activities. Such activities are to be identified by organizational and geographic location, and are to be included in the Application Report in the responses to examination items.

RESTRICTIONS ON ELIGIBILITY

The intent of Public Law 100-107 is to create an Award process incorporating rigorous and objective evaluation of the applicants' total quality systems underlying products and services. This examination is to include site visits to verify descriptions given in the written applications. Customer satisfaction is to play a major role in the examination. Award recipients are to serve as

appropriate models of total quality achievement for other United States companies. Companies or subsidiaries whose businesses are such that they cannot fulfill these purposes are not eligible. Specifically, three restrictions apply:

1. A company or subsidiary is not eligible if more than one-half of the total quality management operations which underlie the products or services it delivers is conducted outside of the United States.

2. A subsidiary is not eligible if its parent company or other subsidiaries of the parent company are the customer(s) for more than one-half of its total products or services.

3. Individual units or groups of units of "chain" organizations (such as hotels, retail stores or restaurants) where each unit performs a similar function, are not eligible. Similarly individual plants or groups of plants within a company where each plant manufacturers similar products are not eligible.

MULTIPLE - APPLICATION RESTRICTIONS

1. A subsidiary and its parent company may not both apply for Awards in the same year.

2. Only one subsidiary of a company may apply for an Award in the same year in the same category.

FUTURE ELIGIBILITY RESTRICTIONS ON AWARD RECIPIENTS

1. If a company receives an Award, the company and all its subsidiaries are ineligible to apply for another Award for a period of five years.

2. If a subsidiary receives an Award, it is ineligible to apply for another Award for a period of five years.

3. If a subsidiary constituting more than one-half of the business of a company receives an Award, neither that company nor any of its other subsidiaries is eligible to apply for another Award for a period of five years.

APPLICATION INSTRUCTIONS

1 APPLICATION FORM. Complete the four-page Application Form.

2. SITE LISTING AND DESCRIPTORS FORMS. Complete the Site Listing and Descriptors Forms if the applicant company has more than one location. Include corporate headquarters in this listing.

3. WRITTEN REPORT. Provide an Application Report addressing the examination items. A Basic Report is required from all applicants. Supplemental Sections are required from some applicants. (See instructions.)

4. TO APPLY. Send 15 copies of the complete application along with the fee payment to:

Malcolm Baldrige National Quality Award
P.O. Box 443
Milwaukee, WI 53201-0443

(Overnight Mailing Address)
310 W. Wisconsin Ave.
Suite 500
Milwaukee, WI 53203

APPLICATIONS MUST BE POSTMARKED OR CONSIGNED TO AN OVERNIGHT MAIL DELIVERY SERVICE BY MAY 5, 1989, to be eligible for the 1989 Awards.

An incomplete application will result in disqualification from the 1989 Award. The Award Office staff is available to answer questions about the application and about eligibility.

APPLICATION
MALCOLM BALDRIGE NATIONAL QUALITY AWARD

1.

1 Applicant

Company Name _____

Address _____

_____

2 Highest Ranking Official

Name _____

Title _____

Address _____

_____

Telephone No. _____

3 Size of Company

Number of Employees _____

Number of Sites _____

Sales Preceding Fiscal Year (circle one)

0-$1M	$10M-$100M	$500M-$1B
$1M-$10M	$100M-$500M	Over $1B

4 Subsidiary Designation (check one)

☐ No (Go to Item 5) ☐ Yes (continue)

Parent Company _____

Address _____

_____

Highest Official _____

Title _____

Does Applicant comprise over 50% of parent company (check one)

☐ No ☐ Yes

Name document supporting subsidiary designation?

_____

Include one copy of this document with the application

5 Description of Products and Services

6 Award Category (check one)

☐ Manufacturing ☐ Service ☐ Small Business

7 Supplier and Dealer Networks

Number of Suppliers _____

Numbers of External Sales Organizations:

Dealers _____ Distributors _____

Franchises _____ Other (Type/Number) _____

_____ _____

_____

This form may be copied

Company Name _____

8 **Industrial Classification**
List three most descriptive two digit SIC Codes (See Page 10)

_____ _____ _____

9 **Report Components**

Number of **Site Listing and Descriptors Forms** Submitted _____

Basic Written Report only _____

Basic Report and _____ Supplemental Sections

10 **Official Inquiry Point**

Name _____

Title _____

Mailing Address _____

_____

Overnight Mailing Address _____

_____

Telephone No. _____

Telefax No. _____

11 **Fee** (see instructions)

Enclosed is $ _____ to cover one Basic Report and _____ Supp. Sections

Make check or money order payable to: The Malcolm Baldrige National Quality Award

12 **Statement**

We understand that this application will be reviewed by members of the Board of Examiners. Should our company be selected for one or more site visits, we agree to host the site visit(s) and to facilitate an open and unbiased examination. We understand that the company must pay reasonable costs associated with any site visit(s).

OFFICIAL USE ONLY

13 **Signature, Authorizing Official**

X _____ Date _____

Name _____

Title _____

Address _____

Telephone No. _____

This form may be copied

Company Name _____

MALCOLM BALDRIGE NATIONAL QUALITY AWARD

3.

14 **Application Abstract**

Submit an abstract of the Application Report and Supplemental Sections. Use a fixed pitch font of 12 or fewer characters per inch or a proportional spacing font of point size 10 or larger. Highlight important quality achievements and indicators of customer satisfaction.

This form may be copied

Company Name

14 Continue Abstract

This form may be copied

STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODES

Manufacturing and Products

Code	Sector	Code	Sector
01	Agriculture - crops	25	Furniture and fixtures
02	Agriculture - livestock	26	Paper and allied products
08	Forestry	27	Printing and publishing
09	Fishing and hunting	28	Chemicals
10	Metal mining	29	Petroleum refining
12	Coal mining	30	Rubber and plastics
13	Oil and gas extraction	31	Leather and leather products
14	Mineral quarrying	32	Stone/clay/glass/concrete products
15	General building contractors	33	Primary metal industries
16	Heavy construction contractors	34	Fabricated metal products
17	Special trade contractors	35	Machinery/computer equipment
20	Food products	36	Electrical/electronic equipment
21	Tobacco products	37	Transportation equipment
22	Textile mill products	38	Instruments/clocks/optical goods
23	Apparel	39	Miscellaneous manufacturing
24	Lumber and wood products		

Services

Code	Sector	Code	Sector
07	Agricultural services	61	Credit agencies
40	Railroad transportation	62	Security & commodity brokers
41	Local & interurban transport	63	Insurance carriers
42	Trucking and warehousing	64	Insurance agents
44	Water transportation	65	Real estate
45	Air transportation	67	Holding & other investment offices
46	Pipelines/except natural gas	70	Hotels and lodging places
47	Transportation services	72	Personal services
48	Communications	73	Business services
49	Electric/gas/sanitary services	75	Auto repair and services
50	Wholesale trade/durable goods	76	Miscellaneous repair services
51	Wholesale trade/nondurable goods	78	Motion pictures
52	Retail building materials	79	Amusement and recreation
53	General merchandise stores	80	Health services
54	Food stores	81	Legal services
55	Auto dealers & service stations	82	Educational services
56	Apparel and accessory stores	83	Social services
57	Furniture stores	84	Museums and art galleries
58	Eating and drinking places	86	Membership organizations
59	Miscellaneous retail	87	Professional services
60	Banking	89	Miscellaneous services

APPLICATION FORM INSTRUCTIONS

GENERAL INSTRUCTIONS

Type or very clearly print all information requested. The Application Form may be duplicated and single-sided pages submitted. Item 4 requires an attachment if the applicant is a subsidiary. Applicants must submit an Application Form, including the subsidiary attachment, with each copy of the Application Report submitted.

ITEM INSTRUCTIONS

ITEM 1. APPLICANT. Provide the official name and mailing address of the organization applying for the Award.

ITEM 2. HIGHEST RANKING OFFICIAL. Provide the name, title, mailing address, and telephone number of the applicant's highest ranking official.

ITEM 3. SIZE OF COMPANY. Give the estimated number of employees of the applicant as of the date the application is submitted. Give the number of different sites of all units involved with the products or services sold by the applicant. Separate sites need not be counted for offices or other work areas located near each other if the company considers them as one location for business and personnel purposes. (If there is more than one location, then details about each site, including headquarters, are to appear on the Site Listing and Descriptors Form.) Circle the appropriate range for sales of the company for the preceding fiscal year. The applicant is reminded that all information is confidential and that only a range is being requested to provide an appropriate perspective for the Examiners.

ITEM 4. SUBSIDIARY. A broad interpretation of the word subsidiary is used for purposes of this Award. See page 4. If the applying organization is a component of a larger company, then information about the parent company and the highest official of the parent company must be supplied. A short document or the appropriate page(s) from a company publication showing the organization of the parent company and its relationship to the applying unit should be attached to the application form. Indicate the name of this attachment.

ITEM 5. DESCRIPTION OF PRODUCTS AND SERVICES SOLD. In the space provided, describe the types of products or services sold by the applicant. Indicate the approximate percent each type represents of the applicant's total sales. It is not necessary to list individual products or services.

ITEM 6. AWARD CATEGORY. Based on eligibility discussed on page 4 of the 1989 guidelines, indicate which one of the three Award categories pertains.

ITEM 7. SUPPLIER AND DEALER NETWORKS. Summarize the number and types of suppliers of goods and services needed for the applicant's output. If the applicant relies on external sales organizations, indicate the approximate number of each type.

ITEM 8. INDUSTRIAL CLASSIFICATION. From page 10, choose the three SIC codes which best describe the applicant's products or services.

ITEM 9. REPORT COMPONENTS. Indicate all forms and reports submitted as part of the application.

ITEM 10. OFFICIAL INQUIRY POINT. As the examination proceeds, the administrator may need to contact the applicant for additional information. Give the name, address and telephone number of the corporate official with authority to provide additional information or arrange site visits.

ITEM 11. FEES. Indicate fees due: $2000 for a Basic Report for applicants in the manufacturing category or the service category, plus $1200 for each Supplemental Section; $1200 for an applicant in the small business category. Payment must be submitted with the application.

ITEM 12. RELEASE STATEMENT. Please read this section carefully. A signed application indicates that the applicant agrees to the terms and conditions stated here.

ITEM 13. AUTHORIZING OFFICIAL. The signature of the applicant's highest ranking official is required and indicates the applicant will comply with the terms and conditions stated in the document.

ITEM 14. APPLICATION ABSTRACT. Two pages are provided for a summary of the application. Use a fixed pitch font of 12 or fewer characters per inch or a proportional spacing font of point size 10 or larger in preparing this abstract. Use these two pages only and type within borders provided.

SITE LISTING AND DESCRIPTORS FORM

INSTRUCTIONS

Since the Award focuses on the applicant's total quality system, it is important that the Examiners have a good understanding of the size, structure and functions of the different corporate units. In addition, sufficient information must be provided on the products or services produced at each location to make a sound determination of the number of locations to be examined if the company is selected for a site visit. Instructions for filling out the Site Listing and Descriptors Form follow:

A. ADDRESS OF SITE. Provide the complete address of the site.
B. RELATIVE SIZE. Provide the approximate percent of the applicant's employees at each site. Provide the approximate percent of the applicant's sales accounted for by the output of each site. Use not applicable (N/A) for percent sales of headquarters or similar offices when appropriate.

C. LINKAGE TO APPLICATION REPORT. Indicate which part of the Application Report addresses the examination items for each site. Check the Basic Report column if that is where it is addressed or write the number of the Supplemental Section in which the items are addressed. (See page 16 for guidelines on how to determine if Supplemental Sections are needed.)

D. FUNCTIONAL DESCRIPTION. Describe the types of products or services which are the output of the site. It may be necessary to state the relationship between the output of the site and the applicant's final products and services. It is not necessary to list every product or service.

E. SUMMARIES OF MULTIPLE SITES. In cases where the applicant has many sites performing the same function, these sites may be aggregated under one listing. Instead of the addresses for each, a summary statement about the locations may be made. If site visits are to be conducted, a more detailed listing will be requested at that time.

SITE LISTING AND DESCRIPTORS

A. Address of Site	B. Relative Size as % Total Company		C. Link to Application Report		D. Functional Description of Site Products Produced or Services Provided
	Employee	Sales	Basic	Sup. #	

Provide all the information for each site except where multiple sites produce similar products or services. In that case, only one Functional Description need be prepared. However, all other information should be provided for each of the sites. Consult instructions for dealing with those cases where the number of sites to be listed is very large.

This Form May Be Copied

APPLICATION REPORT -- INSTRUCTIONS

OBJECTIVE

The objective of the Application Report is to allow applicants to provide information on quality management of products and services and on results of quality improvement processes and to permit a rigorous evaluation to be performed by the Board of Examiners. Each applicant must prepare an Application Report consisting of (1) a brief overview of the applicant's business and (2) responses to the 44 examination items in the Award Examination. A completed Application Report contains the Basic Report, which all applicants must submit, and one or more Supplemental Sections, which some applicants must submit.

PREPARING THE OVERVIEW

The overview should inform the reader of the business climate in which the applicant operates, the general operating conditions existing in the facilities of the applicant, and the relationship of the applicant to the rest of the industry.

The overview provides the applicant the opportunity to "set the stage" for the examiners to better understand significant circumstances impacting on the applicant's business. The type of equipment and facilities used by the applicant should be described in broad terms. Changes taking place in the industry should be identified, such as changes in production techniques, consolidation of facilities, foreign and domestic competition, distribution channels, or selling price.

The overview should also identify factors in the competitive quality climate that are significant, such as industry-wide upgrading of quality or service, lengthening of warranties, extensive adoption of modern quality techniques or use Just In Time procedures. Where applicable, applicants should describe the regulatory climate in which they operate or the impact of environmental concerns on their activities. The applicant's position in the industry, measured by sales and by quality reputation, should be described. Where this position has changed in recent years, the change should be noted, and apparent reasons for the change described.

If the applicant is a subsidiary, a description of the organizational structure and management links to the parent organization should be presented. A comparison to the parent organization of the number of employees, of the sales volume, and of the products and services offered should be included.

DESCRIPTION OF THE EXAMINATION

The Malcolm Baldrige National Quality Award Examination is intended for manufacturing and service businesses of any size. The examination has been designed to permit evaluation of the strengths and areas for improvement in applicant's quality systems and of quality results. Evaluations do not depend upon an applicant's overall organization or whether or not the applicant has a quality department or quality officer.

The Award Examination addresses all aspects of a total quality management system and quality improvement results through seven categories of examination items. The examination items are grouped under sets of subcategories which represent the principal components of the seven categories. Below is a description of the Award Examination along with general guidance for preparing an Application Report.

CATEGORIES

The seven categories for the Award Examination are:
1.0 - Leadership
2.0 - Information and Analysis
3.0 - Strategic Quality Planning
4.0 - Human Resource Utilization
5.0 - Quality Assurance of Products and Services
6.0 - Quality Results
7.0 - Customer Satisfaction

Each category is assigned a number of points, totaling to 1000 points. Applicants must respond to all seven categories.

SUBCATEGORIES

Each category has from two to seven subcategories—numbered with two digits from 1.1 to 7.3. In all, there are 27 subcategories in the examination. Subcategories represent major areas for management attention for the most general quality system.

EXAMINATION ITEMS

Each subcategory has from one to seven examination items numbered with three digits from 1.1.1 to 7.3.5 In all, there are 44 examination items in the Award examination. All information submitted by applicants is in response to specific requirements given in these examination items. Because the Examination is integrated, with examination items organized by category, applicants are encouraged to become familiar with the emphasis and requirements of all items before responding to any one item.

AREAS TO ADDRESS

Each examination item includes a set of Areas to Address, designated by lower case letters and enclosed within a box alongside the item. The Areas to Address are intended to clarify and illustrate the intent of the item. Most Areas to Address pertain to all businesses. Each applicant is expected to respond to the Areas to Address that pertain to their business. Because the importance of the Areas to Address may differ from business to business, and because they may overlap, applicants should respond to examination items as a whole, addressing them in an order and with an emphasis reflecting the applicant's business and quality system. No separate labeling of Areas is required. In responding to an item, applicants may address relevant areas in addition to those included with the item. If any Areas to Address listed does not pertain to the applicant's business or quality system, the applicant must provide a one or two sentence explanation at the end of the response to the item as to why the Area to Address is not applicable.

CHANGES FROM 1988 EXAMINATION

The 1989 Malcolm Baldrige National Quality Award Examination is built upon the same total quality value system, and uses the same basic approach as the 1988 examination. However, several changes have been introduced based upon comments by applicants and members of the Board of Examiners and upon experiences gained in the first year's processes.

Changes from 1988 include reducing the number of examination items from 62 to 44. This reduction has been brought about by narrowing the scope of each of the seven categories to minimize overlap among them. The seven items requesting information on unique and innovative approaches in the 1988 Examination have been eliminated as separate items. In 1989 applicants are encouraged to integrate and highlight their unique and innovative approaches within their overall responses to the 44 examination items. However, applicants should avoid undue claims for uniqueness and innovation, highlighting their approaches in cases when the evidence for uniqueness and innovation is very well founded, and when the unique contributions should be widely publicized if the applicant receives an Award.

The scoring criteria given under each item in the 1988 Examination are repiaced with Areas to Address. In 1989, scoring criteria and a description of the factors in scoring are given separately (see page 17) and pertain to all examination items.

In 1989 there is more emphasis on quantitative approaches, and use of comparative and benchmark data. The term "benchmark," as used in the Examination, refers to measures that represent both appropriate bases for comparison and indicators of the best performance levels anywhere in the world. Benchmarks may apply to attributes of products or services, operating performance, or any other area where a company might seek information to measure itself against the best, worldwide. Thus, appropriate benchmarks may be obtained not only from sources within an industry but also from other industries. In presenting and using comparative and benchmark data, applicants should briefly summarize sources for the data used.

RESPONDING TO EXAMINATION ITEMS

Responses to examination items should be concise, factual, and quantitative. Responses should contain descriptive information and data which show the applicant's approach to defining, measuring, and achieving quality objectives, major gains currently being realized, key trends, and projections for future quality improvements based upon reliable quantitative information. To the maximum extent possible, applicants should provide comprehensive information and data which underscore their total quality approach and results. Use of graphs and tables, properly labeled and compactly presented, is strongly encouraged. Lengthy narratives on specific techniques or on the importance of certain approaches to quality objectives are discouraged.

TREND DATA

Several examination items call for trend data. Trend data should cover a time period sufficient to demonstrate progress, and to show that improvements have been *sustained*. The time period may span five years or more, and in most cases at least two years. This will allow applicants who have set up quality systems in recent years and can demonstrate clear progress to show their early trend results. Data should be presented in graphical, tabular, or other compact form.

USE OF BASIC REPORT AND SUPPLEMENTAL SECTIONS

All applicants must prepare a Basic Report addressing all of the examination items. In order to maintain an equivalent level of detail for all sizes and types of companies and subsidiaries, certain applicants may need to provide Supplemental Sections. Below is an outline of the key factors and guidelines for the Basic Report and Supplemental Sections.

Single or Related Product and Service Lines Served by a Single Quality System. Only the Basic Report is required if the applicant has a single quality system which supports all its product or service lines and if the products or services are essentially similar in terms of customers, technology, types of employees, planning, and quality.

Two or More Diverse Product or Service Lines and/or Dissimilar Quality Systems. In such cases, the Basic Report and one or more Supplemental Sections are required. The Basic Report should encompass the largest aggregation of similar product or service lines as described above which are supported by a single quality system. Together, the Basic Report and the Supplemental Sections must cover all products and/or services and all quality systems of the applicant.

In summary, the use of Supplemental Sections is called for primarily when the application covers units of a company which are in essentially different businesses. They are not necessary when similar products are manufactured in different divisions using similar quality systems.

FORMAT FOR APPLICATION REPORT

The Application Report should contain the same category, subcategory, and item numerical designations as in the examination. The Application Report must be typed on standard 8-1/2 by 11-inch paper using a fixed pitch font of 12 or fewer characters per inch or a proportional spacing font of point size 10 or larger. Pages may be printed on both sides.

The overview of the applicant's business must be no longer than two single-sided pages. A separate two-page overview may be written for each Supplemental Section.

For the manufacturing category and the service category, the Basic Report is limited to a maximum of 75 single-sided pages including pictures, graphs, figures, data tables, and appendices. Supplemental Sections are limited to a maximum of 50 single-sided pages. For Small Businesses the Basic Report is limited to 50 pages. In all cases the two-page overviews, dividers, covers, tab separators, title pages, and tables of contents are not counted as part of the page limit.

The use of bulky binders or similar heavy covers is discouraged. Their use decreases the ease of handling and shipping in all phases of the examination process.

SCORING CRITERIA

INTRODUCTION

The system for scoring examination items is based upon three evaluation dimensions: (1) approach; (2) deployment; and (3) results. All examination items require applicants to furnish information relating to one or more of these dimensions. Specific criteria associated with the evaluation dimensions are described below.

APPROACH

Approach refers to the methods the company uses to achieve the purposes addressed in the examination items. The scoring criteria used to evaluate approaches include one or more of the following:

- the degree to which the approach is prevention based
- the appropriateness of the tools, techniques, and methods to the application
- the effectiveness of the use of tools, techniques, and methods
- the degree to which the approach is systematic, integrated, and consistent
- the degree to which the approach embodies effective self- evaluation, feedback, and adaptation cycles to sustain continuous improvement
- the degree to which the approach is based upon quantitative information that is objective and reliable
- the indicators of unique and innovative approaches, including significant and effective new adaptations of tools and techniques used in other applications or types of businesses

DEPLOYMENT

Deployment refers to the extent to which the approaches are applied to all relevant areas and activities addressed and implied in the examination items. The scoring criteria used to evaluate deployment include one or more of the following:

- the appropriate and effective application to all transactions and interactions with customers, providers of goods and services, and the public
- the appropriate and effective application to all internal processes, activities, facilities, and employees
- the appropriate and effective application to all product and service characteristics

RESULTS

Results refers to outcomes and effects in achieving the purposes addressed and implied in the examination items. The scoring criteria used to evaluate results include one of more of the following:

- the quality levels demonstrated
- the contributions of the outcomes and effects to quality improvement
- the quality improvement gains
- the demonstration of sustained gains
- the breadth of quality improvement gains
- the significance of gains in terms of their importance to the company's business
- the comparison with industry and world leaders
- the company's ability to account for gains in terms of specific quality improvement actions

EXAMINATION CATEGORIES, SUBCATEGORIES AND POINT VALUES

1989 Examination Categories/Subcategories		Maximum Points	Percent of Total
1.0	**LEADERSHIP**	**120**	**12**
1.1	Senior Management	30	
1.2	Quality Values	20	
1.3	Management System	50	
1.4	Public Responsibility	20	
2.0	**INFORMATION AND ANALYSIS**	**60**	**6**
2.1	Scope of Data and Information for "Management by Fact"	25	
2.2	Data Management	15	
2.3	Analysis and Use of Data for Decision Making	20	
3.0	**STRATEGIC QUALITY PLANNING**	**60**	**6**
3.1	Planning Process	30	
3.2	Plans for Quality Leadership	50	
4.0	**HUMAN RESOURCE UTILIZATION**	**150**	**15**
4.1	Management	25	
4.2	Employee Involvement	40	
4.3	Quality Education and Training	30	
4.4	Employee Recognition	20	
4.5	Quality of Worklife	35	
5.0	**QUALITY ASSURANCE OF PRODUCTS AND SERVICES**	**140**	**14**
5.1	Design and Introduction of New or Improved Products and Services	25	
5.2	Operation of Processes Which Produce the Company's Products and Services	20	
5.3	Measurements and Standards for Products, Processes and Services	15	
5.4	Audit	20	
5.5	Documentation	10	
5.6	Quality Assurance of Operations and Business Processes	25	
5.7	Quality Assurance of External Providers of Goods and Services	25	
6.0	**QUALITY RESULTS**	**150**	**15**
6.1	Quality of Products and Services	70	
6.2	Operational and Business Process Quality Improvement	60	
6.3	Quality Improvement Applications	20	
7.0	**CUSTOMER SATISFACTION**	**300**	**30**
7.1	Knowledge of Customer Requirements and Expectations	40	
7.2	Customer Relationship Management	125	
7.3	Customer Satisfaction Methods of Measurement and Results	135	
	TOTAL POINTS	**1000**	

1989 EXAMINATION

1.0 LEADERSHIP (120 POINTS)

The *Leadership* category examines primarily how the senior executives create and sustain a clear and visible quality value system along with a supporting management system to guide all activities of the company. Also examined are the senior executives' and the company's leadership and support of quality developments both inside and outside the company.

1.1 SENIOR MANAGEMENT

1.1.1 (30 pts.) Describe the senior executives' leadership, personal involvement and visibility in developing and sustaining an environment for quality excellence.

Areas to Address

a. extent of personal involvement in quality-related activities such as planning, assessment and review of quality plans and progress, teams, giving and receiving education and training, recognition of employees, learning about the quality of domestic and international competitors

b. communication of company's quality vision to all levels, functional units, and employees

c. evidence of leadership to reinforce customer satisfaction as the priority company objective and quality as a principal strategy

d. accessibility to and routine contact with employees, customers, and suppliers

e. communication (speeches, publications, interviews) of quality excellence outside the company: suppliers and other providers of goods and services; customers; national, trade, business, and professional groups; community organizations; and schools

NOTE: The term senior executives refers to the highest ranking official of the organization applying for the Award and those reporting directly to that official.

1.2 QUALITY VALUES

1.2.1 (20 pts.) Describe the company's quality values, how they are projected in a consistent manner, and how "ownership" of the values throughout the company was achieved and is reinforced.

Areas to Address

a. written policy, mission, guidelines, other documented statements of quality values, or other bases for clear and consistent communication

b. brief summary of the content of policy, mission, or guidelines that demonstrate the quality values

c. reinforcement and assessment of "ownership" at all levels

d. recent or present actions that demonstrate the status of quality values with respect to other considerations of the business, such as short-term profits and schedules

e. approach to building the policies, mission, and values into the leadership process

1.3 MANAGEMENT SYSTEM

1.3.1 (30 pts.) Describe how the company integrates quality values into day-to-day management of operations.

Areas to Address

a. clearly defined customer satisfaction and quality improvement objectives

b. roles, responsibilities and involvement of all levels of management in quality improvement

c. allocation of resources to quality improvement and awareness

d. formal and informal reviews of status and plans

e. types of actions taken to assist units not achieving quality plans

f. improvement of the quality management process

1.3.2 (20 pts.) Describe how senior management creates and maintains close cooperation across functional and departmental lines and at different business locations to achieve quality objectives.

Areas to Address

a. description of cross-functional management processes such as interdepartmental quality improvement and problem prevention teams

b. steps taken to foster effective cooperation such as use of "internal customer" and user/provider techniques

c. key indicators of improved integration

1.4 PUBLIC RESPONSIBILITY

1.4.1 (20 pts.) Describe how the company extends its quality leadership to the external community and integrates its responsibilities to the public for health, safety, environmental protection, and other areas of business practice into its quality policies and systems.

Areas to Address

a. promoting quality awareness and teaching quality techniques to customers, suppliers, stockholders, and other external groups

b. encouraging employee leadership and involvement in quality activities of professional, local, national, trade, and business groups and in national and international standards activities

c. full integration of public health and safety, environmental protection, and waste management requirements into overall quality policies, systems, and continuous improvement objectives

d. company's leadership in promoting high standards in health, safety, environmental protection, and business ethics

2.0 INFORMATION AND ANALYSIS (80 POINTS)

The *Information and Analysis* category examines the scope, validity, use, and management of data and information that underlie the company's total quality system. Also examined is the adequacy of the data and information to support a prevention-based approach to quality using "management by fact."

2.1 SCOPE OF DATA AND INFORMATION FOR "MANAGEMENT BY FACT"

2.1.1 (25 pts.) Describe the company's information systems used in the management, evaluation, and planning of quality.

Areas to Address

a. scope of data: customers, suppliers, internal operations, quality indicators for products and services, employees, competitive comparisons, benchmarks, safety, and environmental

b. the process of determining those items to be included in the quality-related information systems

NOTE: The purpose of this item is to permit the applicant to demonstrate the breadth and depth of the data assembled as part of its total quality management effort. Applicants should give very brief descriptions of the types of data under major headings such as employees and subheadings such as education and training, teams, and recognition. Under each subheading, give a brief description of the data in the information system. Actual data should not be reported in this item. Such data are requested in Categories 4, 6, and 7.

2.2 DATA MANAGEMENT

2.2.1 (15 pts.) Describe how the company ensures that key data are accurate, timely, and available.

Areas to Address

a. steps to ensure validity

b. steps to ensure timely update

c. consistency and standardization of data

d. access to the information wherever and whenever needed

2.3 ANALYSIS AND USE OF DATA FOR DECISION MAKING

2.3.1 (20 pts.) Describe how data are analyzed for timely identification of opportunities or problems, and used for prevention.

Areas to Address

a. principal approaches to identify opportunities or problems

b. root cause determination

c. design and analysis of countermeasures or remedies to address the root causes

d. follow-up analysis to verify that countermeasures or remedies produce the expected results

e. methods used in the analysis of data, including statistical techniques

f. recent improvements in the use of information for quality management

3.0 STRATEGIC QUALITY PLANNING (80 POINTS)

The *Strategic Quality Planning* category examines the company's planning process for retaining or achieving quality leadership and how the company integrates quality improvement planning into overall business planning. Also examined are the company's short-term and long-term priorities to achieve and/or sustain a quality leadership position.

3.1 PLANNING PROCESS

3.1.1 (30 pts.) Describe the company's overall planning process for short- and long-term quality improvement that will result in its retaining or achieving quality leadership.

Areas to Address
a. relationship of quality planning to overall business planning
b. principal types of data, information, and analyses used in planning
c. inclusion of suppliers, dealers, distributors and other external providers of goods and services in planning and plans
d. selection of well-defined, well-coordinated priority initiatives or projects with associated quality assurance and project review plans
e. commitment of resources to projects
f. integration of continuous improvement activities of all work units into plans
g. employee involvement in planning
h. planning reviews and adjustments including reallocations
i. improvement of the planning process

3.2 PLANS FOR QUALITY LEADERSHIP

3.2.1 (25 pts.) Outline the company's approach to selecting quality-related data for competitive comparison and world-class benchmarks and how it analyzes and uses these data to plan for quality.

Areas to Address
a. basis for selection of criteria for competitive comparisons and world-class benchmarks
b. sources of competitive and benchmark data
c. scope of competitive and benchmark data: product and service quality, business operations, processes, employee-related, customer service, and other
d. types of analyses carried out on competitive comparison and benchmark data to plan for quality
e. principal roles competitive and benchmark data and analyses play in company planning

3.2.2 (25 pts.) Summarize the company's principal quality priorities and plans for the short term (1-2 years) and longer term (3-5 years or more).

Areas to Address
a. principal priorities and their relationship to the company's quality leadership objectives
b. how plans affect suppliers, dealers, distributors, and other external providers of goods and services
c. resources committed to the plan
d. projection of major changes anticipated in the company's competitive quality position based upon implementation of the plan

4.0 HUMAN RESOURCE UTILIZATION (150 POINTS)

The *Human Resource Utilization* category examines the effectiveness of the company's efforts to develop and utilize the full potential of the work force for quality and to maintain an environment conducive to full participation, continuous improvement, and personal and organizational growth.

4.1 MANAGEMENT

4.1.1 (25 pts.) Outline the company's current and future (1-2 years and 3-5 years or more) priorities for improving the utilization of all employees in quality improvement.

Areas to Address

a. integration of human resource plans with quality requirements of business plans

b. key strategies for increasing the effectiveness and productivity of all employee categories, including hourly and bargaining unit employees

c. principal priorities

d. how the company manages, evaluates, and improves its human resource plans

e. management's role in human resource utilization, including seeking feedback from employees

4.2 EMPLOYEE INVOLVEMENT

4.2.1 (20 pts.) Summarize the means available for all employees to contribute to quality improvement.

Areas to Address

a. approaches to enhanced employee authority to act (empowerment)

b. employee recourse in cases of potential quality deficiencies or compromises

c. quality improvement team participation: within functional units, cross-functional, and involving suppliers and other external groups, as appropriate

d. suggestion system or other opportunities for employees to contribute and how the company gives feedback to contributors

e. ease of access by employees to management beyond immediate supervisors

f. how the company encourages employee innovation

4.2.2 (20 pts.) Summarize and assess trends in employee involvement.

Areas to Address

a. suggestion trends, adoption rates, percent of employees making suggestions, and other indicators of contributions from all employee categories

b. team participation--trends and indicators of participation by all employee categories

c. appropriate comparisons and assessment of current levels of involvement

d. how effectiveness and benefits of involvement and empowerment are assessed

NOTE: See page 16 for instructions on how to respond to items requiring trend data.

4.3 QUALITY EDUCATION AND TRAINING

4.3.1 (30 pts.) Summarize for up to 5 years the types of quality education and training received by employees in all employment categories.

Areas to Address

a. approach to deciding what quality education and training is needed

b. quantitative measures of types and extent of quality education and training, including quality orientation of new employees, percent of employees receiving education and training in each category, quality education and training costs per employee, average hours of quality education and training annually for all employee categories

c. employee categories selected to receive special education and training in statistical and other quantitative methods, and rationale for selection

d. methods for application of the knowledge and skills acquired and reinforcement of quality education and training

e. how the effectiveness of quality education and training is evaluated and improved

f. availability and utilization of education and training by suppliers, customers, and other external groups, as appropriate

4.4 EMPLOYEE RECOGNITION

4.4.1 (20 pts.) Describe how the company recognizes employees for contributions to quality improvement and summarize trends in recognition.

Areas to Address

a. types of recognition, including opportunities for peer recognition

b. methods for achieving overall balance--between individual and team recognition, and between individual objectives and organizational objectives

c. how company assesses the effectiveness of types of recognition on motivation

d. data regarding percent of employees and teams recognized in different employee categories by type of recognition

4.5 QUALITY OF WORKLIFE

4.5.1 (15 pts.) Describe how the company safeguards the health and safety of employees, ensures comfort and physical protection, and maintains a supportive work environment.

Areas to Address

a. analysis of root causes of accidents and work-related health problems and prevention of adverse conditions

b. inclusion of quality of worklife factors such as health, safety, satisfaction, well-being, morale and ergonomics in quality assurance and quality improvement activities

c. mobility, flexibility, and retraining in job assignments, e.g., when changes in technology or work processes result in elimination of some jobs

d. counseling and employee assistance

e. how employee satisfaction and the principal factors that contribute to it are determined

f. employee feedback on quality-related aspects of the company's operations

4.5.2 (20 pts.) Summarize trends in employee well-being and morale.

Area to Address
Trends and comparisons with industry averages, industry leaders, and others as appropriate in:
a. safety
b. attendance
c. turnover
d. morale and satisfaction indicators

5.0 QUALITY ASSURANCE OF PRODUCTS AND SERVICES (140 POINTS)

The *Quality Assurance of Products and Services* category examines the systematic approaches used by the company for total quality control of goods and services based primarily upon process design and control, including control of procured materials, parts, and services. Also examined is the integration of quality control with continuous quality improvement.

5.1 DESIGN AND INTRODUCTION OF NEW OR IMPROVED PRODUCTS AND SERVICES

5.1.1 (25 pts.) Describe how new or improved products and services are defined, designed and introduced to meet customer requirements and how processes are designed to produce these products and services.

Areas to Address
a. conversion of customer needs and expectations to product, process, and service specifications
b. methods and their applications for the design, development, and validation of products, processes, and services, including testing and evaluation
c. design review taking into account factors such as safety, health, environment, process reliability, product reliability, measurements, and standards
d. detailed control plan: selecting and setting key process characteristics to be controlled and how they are to be controlled
e. steps taken to minimize introduction time and to ensure compatibility among design, supplied parts and services, manufacture, sales and service

5.2 OPERATION OF PROCESSES WHICH PRODUCE THE COMPANY'S PRODUCTS AND SERVICES

5.2.1 (20 pts.) Describe how the processes which produce the company's products and services are controlled, optimized, and maintained.

Areas to Address
a. determination, evaluation and improvement of capabilities of key process characteristics
b. system for detecting, correcting and preventing upsets of key process characteristics
c. optimization of process performance, including design of experiments
d. assurance of process reliability and availability

5.3 MEASUREMENTS AND STANDARDS FOR PRODUCTS, PROCESSES AND SERVICES

5.3.1 (15 pts.) Describe how the accuracy of measurements used in quality control is assured.

Areas to Address
a. determination of measurement variability (precision and bias) in relation to measurement requirements
b. measurement method validation to ensure capability to meet measurement requirements
c. measurement quality assurance
d. standardization within the company to ensure compatibility

NOTE: Measurements include both on-line and off-line measurements. For physical and chemical measurements used in laboratories and in production, indicate approaches to ensuring that measurements are traceable to national standards, for example, through calibrations, reference materials, or other means.

5.4 AUDIT

5.4.1 (10 pts.) Describe audit and other evaluation methods used to assess the performance of the system for assuring the quality of products and services. (system audit)

Areas to Address
a. types and frequency of system audits and who conducts them: company, customers, government, other
b. what is included in system audits
c. approach to translating audit findings into system improvements

5.4.2 (10 pts.) Describe methods used to assess the quality of products and services. (product or service audit)

Areas to Address
a. types and frequency of product and service audits
b. other approaches used to assess product and service quality
c. approach to translating audit findings into process improvements

5.5 DOCUMENTATION

5.5.1 (10 pts.) Describe documentation and other modes of "knowledge preservation" and transfer to support quality assurance and quality improvement.

Areas to Address
a. documentation system supporting quality assurance, including types of documents and activities covered
b. company standardization--ensuring consistency of operating practices among facilities, where appropriate
c. timely update to keep pace with changes in technology, practice and quality improvement
d. revision and data retention policy; disposal of obsolete documents

5.6 QUALITY ASSURANCE OF OPERATIONS AND BUSINESS PROCESSES

5.6.1 (25 pts.) Describe how the quality of internal support functions and business processes is assured.

Areas to Address
a. how internal product and service standards are set for functions such as research and development, finance and accounting, plant and facilities management, marketing, sales, product service, personnel, and administrative support
b. principal means for quality assurance
c. how quality improvement is assessed; types and frequencies of reviews

5.7 QUALITY ASSURANCE OF EXTERNAL PROVIDERS OF GOODS AND SERVICES

5.7.1 (25 pts.) Describe how the quality of materials, components, products and services purchased from or provided by other businesses is assured.

Areas to Address
a. approach to verification that the company's quality requirements are being met by suppliers, dealers, distributors, and other external providers of goods and services
b. selection, long-term relationships, numbers of suppliers, contractors, and other external providers of goods and services
c. audits, inspections and certification programs
d. recognition programs, education and training, and other assistance

6.0 QUALITY RESULTS (150 POINTS)

The *Quality Results* category examines quality levels and quality improvement based upon objective measures derived from analysis of customer requirements and expectations and from analysis of business operations. Also examined are current quality levels in relation to those of competing firms.

6.1 QUALITY OF PRODUCTS AND SERVICES

6.1.1 (40 pts.) Based upon key product and service quality measures derived from customers needs and expectations, summarize trends in improvement.

Areas to Address
a. trends in key product and service quality measures
b. other objective measures of improved quality
c. connections between quality improvement results and improvement projects or initiatives

NOTE: Key product and service quality measures are the set of principal measurable characteristics of products and services, including delivery and after-sales services, which, taken together, best represent the factors that determine customer satisfaction. Examples include measures of accuracy, reliability, timeliness, performance, behavior, delivery, documentation and appearance.

6.1.2 (30 pts.) Based upon key product and service quality measures derived from customer needs and expectation, compare the company's current quality levels and trends with industry averages, industry and world leaders.

Areas to Address
a. bases for comparison such as independent reports, analyses, company's evaluations
b. current quality level comparisons
c. trends and current levels and their significance in terms of the company's quality leadership plans

6.2 OPERATIONAL AND BUSINESS PROCESS QUALITY IMPROVEMENT

6.2.1 (30 pts.) Based upon key measures of operating quality, summarize trends in quality improvement and compare the company's operating quality levels with competitors and benchmarks.

Areas to Address
a. trends in key operating quality measures for production activities and for internal support for services
b. trends in key operating quality measures for functions such as research and development, finance, plant and facilities management, marketing, sales, product service, personnel and administrative support
c. comparisons with industry and world leaders
d. connection between quality improvement results and improvement projects

NOTE: Key measures of operating quality are the set of principal measurable characteristics of business processes such as use of people, supplies, energy, and capital reflected in lead times, yields, waste, inventory levels, rework of products and services, first-time success rates, environmental improvements, and other indicators.

6.2.2 (30 pts.) Based upon key measures of product and service quality, summarize trends in improvement in quality of supplies and services furnished by other companies.

Areas to Address
a. trends in key indicators of improvement in quality of supplies and services
b. brief explanation of significant changes in terms of the company's quality improvement projects or initiatives
c. highlight awards the company's suppliers and service providers have received, and the role the company played in helping them improve their quality

6.3 QUALITY IMPROVEMENT APPLICATIONS

6.3.1 (20 pts.) Summarize briefly three applications or projects that illustrate the breadth and effectiveness of the company's quality improvement activities. Select applications or projects not included elsewhere in the company's Award submission.

Areas to Address
Format for application summaries:
a. reason for the application or project
b. number and type of employees and teams involved
c. improvement approaches and techniques
d. results and their impact
e. how improvements are standardized

7.0 CUSTOMER SATISFACTION (300 POINTS)

The *Customer Satisfaction* category examines the company's knowledge of the customer, overall customer service systems, responsiveness, and its ability to meet requirements and expectations. Also examined are current levels and trends in customer satisfaction.

7.1 KNOWLEDGE OF CUSTOMER REQUIREMENTS AND EXPECTATIONS

7.1.1 (40 pts.) Describe how the company determines current and future customer needs and expectations.

Areas to Address
a. process for identifying customer constituencies, potential customers, and their needs and expectations through interviews, surveys, and other contacts
b. other key data and information used in determining needs and expectations
c. frequency, duration, objectivity, and depth of data collection including roles and responsibilities
d. types of analyses performed on data and information
e. segmentation by product and service features to determine the relative importance of these features
f. how the company evaluates and improves the effectiveness of its determination of customer needs and expectations

7.2 CUSTOMER RELATIONSHIP MANAGEMENT

7.2.1 (20 pts.) Describe how the company provides customer service and ensures its continuous improvement.

Areas to Address
a. integration of customer service with overall management
b. ensuring easy access by customers such as toll-free phone numbers for comments, assistance, and reactions
c. tracking system to ensure service responsiveness such as meeting response time and other key standards
d. service and product follow-up and analysis
e. empowering customer-contact employees to resolve problems and to take extraordinary measures when appropriate
f. technology support for customer-contact employees
g. special training, recognition, and attitude/morale determination of customer-contact employees
h. process for improving customer service

7.2.2 (20 pts.) Describe the company's customer service/contact standards, and how they are set and modified.

Areas to Address
a. customer service/contact features for which standards are set
b. deployment in all departments to ensure support for customer service/contact
c. verification that service/contact standards are being followed
d. evaluation and improvement of standards
e. employee involvement in developing, evaluating and improving or changing standards

7.2.3 (20 pts.) Describe the company's commitments to customers on its explicit and implicit promises underlying its products and services.

Areas to Address
a. guarantees and warranties: comprehensiveness, conditions, understandability, and credibility
b. other types of commitment and their meaning
c. changes during the past 3 years in warranties, guarantees, and other commitments made by the company related to improved quality
d. comparison of commitments with those of competitors, including significant relative changes

7.2.4 (25 pts.) Summarize trends in honoring commitments and in improving customer relationships.

Areas to Address
a. trends in key indicators of commitment such as field service, returns, refunds, replacements, repair, repeat services, responsiveness, warranties, and guarantees
b. explanation of trends in terms of changes in commitments and quality of products and services
c. trends in key indicators of success in improving customer relationships and service/contact standards

7.2.5 (10 pts.) Describe the company's complaint-management system and how it operates.

Areas to Address
a. coordination of complaints made to different parts of the company for central review and analysis
b. ensuring easy access for customers to complain
c. active complaint and customer feedback solicitation
d. ensuring that most complaints are resolved promptly by customer-contact employees
e. analysis to understand market consequences of unresolved complaints for policy review
f. process used to improve the complaint-management system

7.2.6 (10 pts.) Describe how the company analyzes complaints and translates them into preventive actions.

Areas to Address
a. complaint analysis process for root cause determination
b. dissemination of complaint information and analysis to relevant departments for prevention
c. improvement of standards, processes, procedures, systems, or instructions and information for customers

7.2.7 (20 pts.) Summarize and explain the company's complaint trends.

Areas to Address
a. complaint trends with explanation of significant changes
b. changes in resolution approaches and resolution times
c. correlation of retention of customers with complaints and complaint resolution

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7.3 CUSTOMER SATISFACTION METHODS OF MEASUREMENT AND RESULTS

7.3.1 (25 pts.) Describe the company's methods for determining customer satisfaction.

Areas to Address
a. selection of key indicators of satisfaction
b. type and frequency of methods used
c. procedures used to ensure objectivity and validity of data
d. segmentation by customer type, if appropriate
e. methods used to analyze customer satisfaction data
f. translation of customer satisfaction information into quality improvement activities

7.3.2 (30 pts.) Briefly summarize the company's customer satisfaction trends.

Areas to Address
a. trends in customer satisfaction indicators and significance of the trends in terms of improvements in the company's product and service quality
b. trends in adverse indicators such as claims, recalls, returns, liability judgments. Briefly describe how major issues were resolved or current status.
c. trends in compliance with federal, state, and local health, safety, and environmental regulations. Briefly describe how major issues were resolved or current status.

7.3.3 (30 pts.) Compare the company's customer satisfaction results with those of competitors in similar markets.

Areas to Address
a. comparison with industry averages, industry and world leaders, as appropriate. Give bases for comparison.
b. surveys, competitive awards, recognition and ratings by independent organizations. Briefly explain surveys, awards, recognition, and ratings.

7.3.4 (20 pts.) Describe how the company monitors gains and losses of customers and analyzes this information for quality improvement.

Areas to Address
a. ensuring validity and objectivity of monitoring methods
b. identification of key product and service features that determine customer retention
c. translation into quality improvement

7.3.5 (30 pts.) Summarize the company's trends in gaining and losing customers.

Areas to Address
a. turnover/retention data and indicators
b. gains and losses relative to size of markets
c. sources of gains: referrals, exports, product and service improvement
d. sources of losses: dissatisfied customers, competition, price, other

1988 AWARD RECIPIENTS

"...we salute three corporations that reflect American industry's dedication to quality. Each of them and thousands of others help keep America strong by making American products the best products available. They and others like them exemplify the belief that quality counts first, foremost, and always. The one trait that characterizes these winners is a never-ending process, a company-wide effort in which every worker plays a critical part. They realize that customer satisfaction through better quality is the goal. They know that America's economic strength and future depend more and more upon the quality of its products..."

Ronald Reagan
November 14, 1988

MOTOROLA INC.

For Motorola, quality improvement leading to total customer satisfaction is the key. Responding to the rapid rise of Japanese firms in world markets for electronics, Motorola's management began an almost evangelical crusade for quality improvement, addressing it as a company issue and, through speeches and full-page ads in major publications, as a national issue. Over the past two years Motorola has received nearly 50 quality awards and certified supplier citations.

Motorola concentrates on several key operational initiatives. At the top of the list is "Six Sigma Quality," a statistical measure of variation from a desired result. In concrete terms, Six Sigma translates into a target of no more than 3.4 defects per million products, customer services included. At the manufacturing end, this requires designs that accommodate reasonable variation in component parts but production processes that yield consistently uniform final products. Motorola employees record the defects found in every function of the business, and statistical technologies are increasingly made a part of each and every employee's job.

Reducing the "total cycle time" is another vital part of the company's quality initiatives. In the case of new products, Motorola's cycle-time reduction program starts the clock ticking the moment the product is conceived. This calls for an examination of the total system, including design, manufacturing, marketing, and administration.

In addition, each of the firms six divisions have "benchmarking" programs that analyze all aspects of a competitor's products.

COMMERCIAL NUCLEAR FUEL DIVISION, WESTINGHOUSE ELECTRIC CORPORATION

Prior to the early 1980's, the Westinghouse Commercial Nuclear Fuel Division's (CNFD) quality goals were geared toward satisfying regulatory requirements for fuel-rod assemblies. Then, motivated by stiff competition and demanding customer requirements, it raised its sights with the objective of being recognized as the world's highest-quality supplier of commercial nuclear fuel.

CNFD is building a quality culture that asks employees to do "the right things right the first time." This philosophy makes every action by every employee a quality initiative. Customer satisfaction is the guiding principle, whether it is the ultimate customer or the next person in the process.

CNFD uses a "Total Quality" approach built upon four imperatives for continuous quality improvement: management leadership, product and process leadership, human resource excellence, and customer satisfaction. Progress is measured by a unique system called "Pulse Points." The system tracks improvements in over 60 key performance areas identified with statistical techniques and other evaluative tools, and it helps set measurable goals within each unit of CNFD.

Product and service improvements attributable to the seven-year old program have paid business dividends. The value of new orders in 1987 was the highest in the decade.

GLOBE METALLURGICAL INC.

While many U.S. makers of ferroalloys (iron-based metals) were closing plants, the Ohio-based company stated its refusal in the most convincing of terms. It initiated a quality-improvement program that has made its products the standards of excellence in the metals industry.

Globe set out in 1985 to become the lowest-cost, highest-quality producer of ferroalloys and silicon metal in the United States. Management was trained in statistical process control, and by year's end, the foundation was laid for a company-wide quality improvement system, called Quality, Efficiency, and Cost (QEC).

Three years later, Globe occupies a quality niche above the competition. With QEC, quality committees were established at every level within the company, from top officials, who serve on the QEC steering committee, to hourly workers, who participate in quality circles. Employees measure performance, track improvements, and report results monthly. Not coincidentally, its share of the U.S. market for high-quality foundry alloys has risen dramatically, sales in Canada and Europe have increased significantly, and profitability has returned.

In quality audits by General Motors, Ford, Intermet, John Deere, and other customers, the firm's scores have set records, resulting in certified supplier status for Globe. Foreign buyers also recognize Globe's commitment to quality. When many European traders place an order for magnesium ferrosilicon alloy they specify that the material must be "Globe quality," a standard that other suppliers must match.

Mr. WALGREN. Thank you, Dr. Reimann. We appreciate that testimony.

Let's turn to Mr. Adams.

Mr. ADAMS. My name is Larry Adams, Vice President, Florida Power and Light Company. I am here because our chairman, John Hudiburg, is in Japan, meeting with the six examiners of the Deming Prize who will judge my company. We have been accepted as an applicant and will be examined in August of this year for the Deming Prize. I am more excited about the Baldrige Award today.

First, I would like to thank and commend you, Mr. Chairman, Congressmen Boehlert, Ritter, and your cohorts, for really having the vision and the courage, and I say courage because you never know what kind of reaction you are going to get to a bill of this type that is going to require total support from both the public and the private sector. You did it, you did the right thing, and we are very appreciative of it.

I am testifying today as Treasurer of the Foundation. I will provide a very brief history of the Foundation and then describe the response the Foundation received from U.S. businesses.

Prior to the enactment of the legislation establishing the Malcolm Baldrige National Quality Award, there had been at least two major centers of support from businesses for the subject award. Mr. Sanford McDonnell, now Chairman Emeritus of McDonnell Douglas Corporation, and Mr. John J. Hudiburg, Chairman and Chief Executive Officer of Florida Power and Light Company, were proponents.

In December of 1987, Secretary of Commerce C. William Verity asked those two gentlemen, McDonnell and Hudiburg, to cofound a private foundation to fund a substantial portion of the Malcolm Baldrige National Quality Award costs. I say a substantial proportion because there are revenues that come in from the applicants for examination fees.

The Foundation, a nonprofit, tax-exempt charitable organization, was formed in February 1988. Mr. Sanford McDonnell was its first President; the Foundation coordinated its fund-raising and operating strategy with the National Bureau of Standards, now the National Institute for Standards and Technology. NIST is the Government agency responsible for management of the award program.

This coordinated effort formulated the award program budgets and annual funding needs. A campaign process was developed, ensuring that a company's contribution the Foundation could not affect the process of selecting award winners. Let me comment. By that, we mean that if we asked Ford to contribute to the Foundation, we had to ask General Motors and Chrysler, and those vertical categories of industries, all major corporations, were asked to participate in contributions and serve as trustees on the Foundation.

An analysis determined that $633,000 would be sufficient to cover the yearly operating expenses of the award program. Further financial assessment concluded a $9.9 million fund-raising goal was necessary to meet the operating revenue requirements in perpetuity. The Foundation's fund-raising strategy centered on a single campaign which would be implemented by the Foundation's board of trustees, and there are now 42. Companies pledging contribu-

tions to the Foundation would be required to pay their pledges in three equal annual installments starting in 1988.

Trustees of the Foundation are CEO's of major U.S. companies involved in quality programs. They were invited by the cofounders of the Foundation to serve as founder trustees and to pledge $150,000 each to the campaign goal.

The response of U.S. business in support of the Foundation and trustees and contributors was overwhelming. Almost every CEO accepted. Attached is a list of the trustees, directors, and current officers of the Foundation. I submit to you, that is probably one of the most prolific lists of CEO's behind a single effort in America today, and it is great that it is for quality.

The exceptional positive response that the campaign received from the trustee CEO's is significant testimony that quality is top priority with leading U.S. companies. Requests for contributions were directed to both manufacturing and service sectors. Pledges from $25,000 to $150,000 have been received from 125 companies.

The Foundation currently has received commitments totaling $10.172 million. There is a $150,000 trustee prospect that is pending, and that will conclude any more fund-raising; it is cut off. By the way, we exceeded the target by $272,000. We are confident that the Foundation endowment will assure the future financial needs of the Quality Award Program.

To manage the endowment, we sent out requests for proposals from six major fund managers throughout the country. We selected Chase of New York. Ninety-one percent of that portfolio is invested in intermediate term bonds, mostly Treasury notes; average maturity, 4.2 years; and average current yield of 9.34 percent.

The Foundation's Directors and Trustees have boldly stepped forward in partnership with the Department of Commerce with substantial funding and personal leadership in support of a program that will motivate companies to make quality an obsession in America, and the Malcolm Baldrige National Quality Award program's inaugural year was successful. It will also provide measurable opportunities for increased application of an improved quality process that will enhance America's international competitive position.

I would like to close with just four basic comments about the response from America, and that is the willingness to compete, the willingness to learn, the willingness to share, and the willingness to replicate. The future looks positive concerning improved understanding and application of quality management systems in America.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Adams follows:]

TESTIMONY OF LAWRENCE H. ADAMS

TREASURER, FOUNDATION FOR THE MALCOLM BALDRIGE

NATIONAL QUALITY AWARD, AND

VICE PRESIDENT, ECONOMIC DEVELOPMENT

FLORIDA POWER & LIGHT COMPANY

BEFORE THE HOUSE SCIENCE, RESEARCH AND TECHNOLOGY

SUBCOMMITTEE

APRIL 18, 1989

MR. CHAIRMAN:

MY NAME IS LAWRENCE H. ADAMS, A VICE PRESIDENT OF FLORIDA POWER & LIGHT COMPANY.

I'M TESTIFYING TODAY AS TREASURER OF THE FOUNDATION FOR THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD. I WILL PROVIDE A BRIEF HISTORY OF THE FOUNDATION AND THEN DESCRIBE THE RESPONSE THE FOUNDATION RECEIVED FROM U.S. BUSINESSES.

PRIOR TO THE ENACTMENT OF THE LEGISLATION ESTABLISHING THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD, THERE HAD BEEN AT LEAST TWO MAJOR CENTERS OF SUPPORT FROM BUSINESSES FOR A U.S. NATIONAL QUALITY AWARD. MR. SANFORD N. MCDONNELL, NOW CHAIRMAN EMERITUS OF MCDONNELL DOUGLAS CORPORATION, AND MR. JOHN J. HUDIBURG, CHAIRMAN AND CHIEF EXECUTIVE OFFICER OF FLORIDA POWER & LIGHT COMPANY, WERE PROPONENTS. IN DECEMBER OF 1987, SECRETARY OF COMMERCE C. WILLIAM VERITY ASKED MESSRS. MCDONNELL AND HUDIBURG TO CO-FOUND A PRIVATE FOUNDATION TO FUND A SUBSTANTIAL PORTION OF THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD COSTS.

THE FOUNDATION, A NON-PROFIT, TAX EXEMPT, CHARITABLE ORGANIZATION, WAS FORMED IN FEBRUARY, 1988. MR. SANFORD N. MCDONNELL WAS ITS FIRST PRESIDENT. THE FOUNDATION COORDINATED ITS FUND RAISING AND OPERATING STRATEGY WITH THE NATIONAL BUREAU OF STANDARDS (NOW THE NATIONAL INSTITUTE FOR STANDARDS AND TECHNOLOGY). N.I.S.T. IS THE

GOVERNMENT AGENCY RESPONSIBLE FOR MANAGEMENT OF THE AWARD PROGRAM. THIS COORDINATED EFFORT FORMULATED THE AWARD PROGRAM BUDGETS AND ANNUAL FUNDING NEEDS. A CAMPAIGN PROCESS WAS DEVELOPED TO INSURE THAT A COMPANY'S CONTRIBUTION TO THE FOUNDATION COULD NOT AFFECT THE PROCESS OF SELECTING AWARD WINNERS.

AN ANALYSIS DETERMINED $633,000 TO BE SUFFICIENT TO COVER YEARLY OPERATING EXPENSES OF THE AWARD PROGRAM. FURTHER FINANCIAL ASSESSMENT CONCLUDED A $9.9 MILLION FUND RAISING GOAL WAS NECESSARY TO MEET OPERATING REVENUE REQUIREMENTS IN PERPETUITY.

THE FOUNDATION'S FUND RAISING STRATEGY CENTERED ON A SINGLE CAMPAIGN WHICH WOULD BE IMPLEMENTED BY THE FOUNDATION'S BOARD OF TRUSTEES (THERE ARE NOW 42 TRUSTEES). COMPANIES PLEDGING CONTRIBUTIONS TO THE FOUNDATION WOULD BE REQUIRED TO PAY THEIR PLEDGES IN THREE EQUAL ANNUAL INSTALLMENTS STARTING IN 1988.

TRUSTEES OF THE FOUNDATION ARE CEO'S OF MAJOR U.S. COMPANIES INVOLVED IN QUALITY PROGRAMS. THEY WERE INVITED BY THE CO-FOUNDERS OF THE FOUNDATION TO SERVE AS FOUNDER TRUSTEES AND TO PLEDGE $150,000 EACH TO THE CAMPAIGN GOAL. THE RESPONSE OF U.S. BUSINESS IN SUPPORT OF THE FOUNDATION AS TRUSTEES AND CONTRIBUTORS WAS OVERWHELMING. ALMOST EVERY CEO ACCEPTED. ATTACHED IS A LIST OF THE TRUSTEES, DIRECTORS AND CURRENT OFFICERS OF THE FOUNDATION. THE EXCEPTIONAL, POSITIVE RESPONSE THE CAMPAIGN RECEIVED FROM TRUSTEE CEO'S IS SIGNIFICANT TESTIMONY THAT QUALITY IS A TOP

PRIORITY WITH LEADING U.S. COMPANIES.

REQUESTS FOR CONTRIBUTIONS WERE DIRECTED TO BOTH MANUFACTURING AND SERVICE SECTORS. PLEDGES FROM $25,000 TO $150,000 HAVE BEEN RECEIVED FROM 125 COMPANIES.

THE FOUNDATION CURRENTLY HAS RECEIVED COMMITMENTS TOTALING $10.172 MILLION, EXCEEDING OUR TARGET BY $272,000. WE ARE CONFIDENT THAT THE FOUNDATION ENDOWMENT WILL ASSURE THE FUTURE FINANCIAL NEEDS OF THE QUALITY AWARD PROGRAM.

THE FOUNDATION DIRECTORS AND TRUSTEES HAVE BOLDLY STEPPED FORWARD IN PARTNERSHIP WITH THE DEPARTMENT OF COMMERCE, WITH SUBSTANTIAL FUNDING AND PERSONAL LEADERSHIP IN SUPPORT OF A PROGRAM THAT WILL MOTIVATE COMPANIES TO MAKE QUALITY AN OBSESSION IN AMERICA. THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD PROGRAM'S INAUGURAL YEAR WAS SUCCESSFUL. IT WILL ALSO PROVIDE MEASURABLE OPPORTUNITIES FOR INCREASED APPLICATION OF AN IMPROVED QUALITY PROCESS THAT WILL ENHANCE AMERICA'S INTERNATIONAL COMPETITIVE POSITION.

FOUNDATION FOR THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD

DIRECTORS AND TRUSTEES

Robert Baldrige
President
Roberts Mills, Inc.

John J. Hudiburg
Chairman & CEO
FPL

John C. Marous
Chairman & CEO
Westinghouse Electric Corporation

John A. Young
President & CEO
Hewlett-Packard Company

TRUSTEES

John F. Akers
Chairman
IBM Corporation

Robert E. Allen
Chairman
AT&T

Dexter F. Baker
Chairman, President & CEO
Air Products and Chemicals, Inc.

Donald R. Beall
Chairman & CEO
Rockwell International

Stephen D. Bechtel, Jr.
Chairman
Bechtel Group, Inc.

Edward A. Brennan
Chairman & CEO
Sears, Roebuck and Co.

James E. Burke
Chairman & CEO
Johnson & Johnson

M. Anthony Burns
Chairman, President & CEO
Ryder System, Inc.

Colby H. Chandler
Chairman & CEO
Eastman Kodak Company

John L. Clendenin
Chairman
BellSouth Corporation

Jeffrey H. Coors
President
Adolph Coors Company

John Creedon
President & CEO
Metropolitan Life Insurance Company

William C. Ferguson
CEO elect
NYNEX Corporation

Gerald Greenwald
Chairman
Chrysler Motors

Richard E. Heckert
Chairman & CEO
E. I. du Pont de Nemours and Company

James R. Houghton
Chairman
Corning Glass Works

Thomas V. Jones
Chairman & CEO
Northrop Corporation

Jerry R. Junkins
Chairman, President & CEO
Texas Instruments Incorporated

TRUSTEES, cont'd.

David T. Kearns
Chairman & CEO
Xerox Corporation

Vernon R. Loucks, Jr.
Chairman & CEO
Baxter International Inc.

J.W. Marriott, Jr.
Chairman & President
Marriott Corporation

H. Eugene McBrayer
President
Exxon Chemical Company

Sanford N. McDonnell
Chairman Emeritus
McDonnell Douglas Corporation

Robert E. Mercer
Chairman & CEO
The Goodyear Tire & Rubber Company

Ruben F. Mettler
Chairman & CEO
TRW Inc.

Roger Milliken
Chairman & CEO
Milliken & Company

Stanley C. Pace
Chairman & CEO
General Dynamics Corporation

Donald E. Petersen
Chairman & CEO
Ford Motor Company

Frank P. Popoff
President & CEO
The Dow Chemical Company

John S. Reed
Chairman
Citicorp/Citibank

Frank H. Richardson
President & CEO
Shell Oil Company

James D. Robinson III
Chairman & CEO
American Express Company

George A. Schaefer
Chairman & CEO
Caterpillar Inc.

Frank A. Shrontz
Chairman & CEO
The Boeing Company

John G. Smale
Chairman & CEO
The Procter & Gamble Company

Frederick W. Smith
Chairman
Federal Express Corporation

Roger B. Smith
Chairman & CEO
General Motors Corporation

Daniel M. Tellep
Chairman & CEO
Lockheed Corporation

OFFICERS

President
John J. Hudiburg
Chairman & CEO
FPL

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John A. Young
President & CEO
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Treasurer
Lawrence H. Adams
Vice President of
Economic Development
FPL

Secretary
Janette M. Lohman
Sr. Corporate Attorney - Taxes
McDonnell Douglas Corporation

LHA:ja 4/5/89

LAWRENCE "LARRY" H. ADAMS

BIOGRAPHICAL INFORMATION

Larry Adams, a native Floridian, is Vice President of Economic Development at Florida Power & Light Company (FPL). He holds memberships in the Florida Economic Development Council; the Industrial Research Development Council of America; and the Edison Electric Institute, where he serves on the international economic development subcommittee. He is on the Beacon Council Board of Directors and is actively involved in local, state, and national economic development activities.

Active in the community, he is past chairman of the Greater Miami Chamber of Commerce and currently is a member of their Board of Governors. He is also a Trustee of Florida Memorial College.

The fourth largest investor-owned electric utility in the United States, FPL is an acknowledged leader in the area of quality improvement, a trend that is changing the face of the American business environment. FPL serves nearly 2.6 million customers in an area comprising approximately half the population of the State of Florida.

FPL is a subsidiary of FPL Group, Inc., a holding company formed in 1984, with utility and non-utility operations. Non-utility operations include insurance, cogeneration, agriculture, real estate development, equipment leasing, cable television, and consulting and training.

A graduate of the Harvard Advanced Management Program Business School, Larry Adams attended Purdue and the University of Miami.

Mr. WALGREN. Thank you very much, Mr. Adams.

Let's recognize the gentleman from New York in deference to his schedule.

Mr. BOEHLERT. Mr. Adams, I first of all will thank you for your testimony, and I hope you will convey to Mr. Hudiburg our deep appreciation for his leadership in this overall effort.

When you mentioned the courage it took to see this thing through, I didn't really think it took much courage; I thought it took a lot of common sense. I can remember being on a high when the Chairman and I walked out of the White House after that magnificent ceremony with the President and Vice President—now President, Secretary Verity, and CEO's from some of the Fortune 100 companies. I was really riding high, until the next day I got a copy of an editorial from one of my small dailies and a newspaper article blasting me for being identified with this program, because a local Chamber executive said, "Our members who run grocery stores and corner stores won't apply for this; this is a big fraud," and the newspaper editorial agreed with that and took me to task. Well, I can't wait to send them the transcript of this hearing.

Dr. Reimann, I would just say, the Chairman and I were chatting briefly earlier, and we couldn't be happier on the selection of you to run this program. You have done a magnificent job. Sometimes—oftentimes, more often than not, Government does things right, and under your leadership we have done this thing right in partnership with the private sector. So I have nothing but praise for you, and I can't wait to get back here so I can personally applaud the winners of these first awards.

Thank you so much.

Mr. WALGREN. Thank you, Mr. Boehlert.

I want to echo the comments of the gentleman from New York, particularly with respect to Mr. Hudiburg, and the way that the private sector has pitched in and picked up this program. It certainly is an eye-opener for me. I personally had not had previous experience with that happening on this scale, and now that you have gathered that endowment, Mr. Adams, you stop at that point? There is no more fund-raising? Is that correct?

Mr. ADAMS. No. We feel that our budget building process was sound. Certain monies have come in ahead of schedule, when we did our financial model as to driving the revenue requirements forever out of that endowment. We think, on the conservative side, that we have adequate funds and it will not be necessary for any more fund-raising.

Mr. WALGREN. And how are they invested? You mentioned the return of the endowment funds at the end of your—

Mr. ADAMS. These are mostly in short-term Treasury notes. You see, we receive the funds in three equal installments. If you pledged $150,000, that would be $50,000 per year payable in June of 1988, 1989, and 1990. Some of those payments have come in early, Mr. Chairman, which are going to increase our yield in the form of interest. So, if anything, we are on the comfortable side of the requirement—financial requirements.

Mr. WALGREN. To what do you attribute the instinctive willingness of companies to commit what is a substantial contribution, I gather, $150,000. Is that what—

Mr. ADAMS. Well, the trustee—to be a founder trustee, it required a $150,000 contribution.

The money was really not the issue, Mr. Chairman. All of these companies or CEO's are involved in quality, knowing full well that they haven't captured and maximized the benefits of total quality control, and the more difficult thing was for them to commit to serve as a trustee on the foundation with a limited amount of time, and I think a greater testimony than money is their willingness to serve and assume responsibility of managing the fund and continued interface with the institute and the quality award program.

Mr. WALGREN. Does that give you substantial confidence about how this movement is being received in the American economy?

Mr. ADAMS. There is no question about it. The first year's corporations examined got a report card, Mr. Chairman, and it indelibly identified the voids that Mr. Ritter was talking about and where they might have felt halfway comfortable they were doing a good job, they now realize that if they are going to move their quality management system up to something that is going to put them in a competitive world-wide position, that they are going to have to learn from the winning companies—in this instance, Westinghouse and Motorola. You know, they are getting hundreds of visitations from companies since they have been announced as a winner of this particular award, and I think the willingness to admit that they need to learn more, understand it, implement it, and fine-tune it is really what is exciting about this whole effort of quality that is evidenced by the quality award.

Mr. WALGREN. As I understand it, the endowment provides the $600,000 or so in operating costs but there still are major fees for any corporation to apply to be considered. How high are those fees, and is there some point that they reach a barrier that would limit the reach of the program?

Mr. ADAMS. I would yield to Dr. Reimann on that question.

Dr. REIMANN. The expenditure, I think, in applying is primarily the time and effort that a company puts into the application, but more and more companies are telling us now that the effort to apply is very closely connected to their quality improvement effort. So they consider it a kind of health check, and they don't really count those costs as application costs, and the cost of a diagnosis with the skills of the people we have been fortunate enough to attract would cost far more than the companies actually end up paying in incremental costs to apply.

Mr. WALGREN. Well, we can come back to that. Let me recognize the gentleman from California, inasmuch as we have a vote on, and then the gentleman from Pennsylvania, who will perhaps not be able to come right back, and I would like to give them the opportunity.

Mr. BROWN. Let me just make a couple of brief comments, and you may respond if you wish. But, first of all, I, as the chairman is, am impressed with the financing arrangements and your ability to raise the funds that you have raised here, and I am, of course, intrigued by the possibility that there may be other worthwhile national objectives that might be financed in the same way.

As an example, I know that at the National Academy of Sciences they have been concerned about their own lack of a national en-

dowment which would give them some opportunity to exercise independent judgment as to the kinds of things that they go into in terms of policy issues of national concern in the science field, and you may have inspired them or other groups to follow your model.

Secondly, let me say that I am very much impressed by this seven-point examination process, and I am going to suggest just three points here that you might want to consider using as a springboard for further involvement.

Looking at the question of public responsibility, which is one of the areas that you address, I notice that you include in that full integration of public health and safety, environmental protection, and waste management requirements into overall quality policies and so forth.

I am struck by reading an article this morning about how Polish steel mills are degrading the environment of Poland, and obviously they haven't paid much attention to this aspect of quality control, probably many others also, but that is one point. A second one is the quality of work life, which you include in your fourth area of analysis, and, thirdly, the design review that is included as part of your fifth matter.

I would like to suggest to you that those kinds of things might be a springboard for much greater involvement from public interest organizations outside of industry itself who are concerned with, say, environmental quality, with labor organizations which, in some cases, might see this whole program as another effort by management to extract more from the labor force; and the inclusion of your concern about the quality of the work life would be an important factor, I think, in getting labor cooperation; and, of course, the whole question of design is one that I have grappled with for many years, because I really feel that this gets at the essence of thinking about more than just the material aspects of the product, the aesthetic aspects of the product, other aspects which create a market demand where sometimes quality itself is merely accepted as something that you expect out of a product.

But excellence of design goes beyond just the quality of the performance itself, and here you might find an opportunity to involve a lot of other people who really are concerned about the overall quality of the artifacts of our civilization from the sense of design. I would like to see that kind of broad base for this, because in the long run that will elevate the quality of our entire society as well as the products which are produced by that society.

Dr. REIMANN. Yes. Thank you very much, Mr. Brown.

Mr. ADAMS. Good point.

Mr. WALGREN. Why don't we suspend at this point, unless there is an immediate response you would like to give to the areas Mr. Brown raised.

Well, then, let's suspend, and please let me ask you to stay with us. Mr. Ritter would like to raise some matters with you, and this will take us about 15 minutes at maximum.

[Recess.]

Mr. WALGREN. Let me call us back together, if I could, and recognize the gentleman from Pennsylvania, Mr. Ritter.

Mr. RITTER. Thank you, Mr. Chairman, and I, too, want to commend Dr. Reimann for his leadership and Mr. Adams and his

chairman, John Hudiburg, for their being the quiet revolutionaries of our time.

Mr. Chairman, I also want to commend you and the ranking member of this subcommittee for having the foresight to do this. Sometimes we do things with fanfare, and sometimes we do things quietly, and the things that we do quietly live on and become very important, and I think this is one of the most important steps we have taken in this subcommittee since I have been in the Congress.

Dr. Reimann, you mention that efforts are under way to assist State and local organizations who wish to establish quality awards. Could you expand on those efforts?

Dr. REIMANN. Yes. There is an effort already going in the State of Connecticut. They have adopted our award concept bodily for an award program that began actually last year. The State of California is moving along quite aggressively now, and North Carolina, and several other States. Members of our examination team have a dialogue going with members of departments of commerce, and so forth, on an award concept.

So there is, we feel, a stirring in the States, and, as you know, Mr. Ritter, the efforts at the State and local levels, these area councils, communities of excellence, and so on, are now springing up and, I think, doing very well. I have a great deal of enthusiasm for these developments, because they are bringing together people from across the traditional lines, and we are hoping that our guidelines, which were meant to be a communication tool across such guidelines, will be a valuable tool for local symposia, workshops, and so on, and we are looking to these groups to recommend to us people to serve on our various boards, and we have been fortunate enough to get members of somewhere between six and ten such councils from across the United States. So this is a very active strategy of the program.

Mr. RITTER. We, I might add, in the Lehigh Valley of Pennsylvania, the area that I represent, have a program called Quality Value, U.S.A., where we have some 50 CEO's of companies, heads of institutions. And we are seeking to regionalize this quality movement in order to just work in parallel to get to the goal of accelerating America's adoption of this quality revolution, knowing that we are starting a little bit late and we need to go as fast as humanly possible to get on the right track.

Let me ask you about logistics. How many applications have you received this year as opposed to last year?

Dr. REIMANN. We haven't received any, and we really don't expect any until the last minute. Last year, 57 of the 66 came in on the last day, and I think it is a testimony to the effort that it takes to do the job. So we are confident that it will happen very roughly the same this year.

Mr. RITTER. Are you expecting more applications?

Dr. REIMANN. We are expecting more, but not dramatically more. Many companies have told us now that they are looking to 1990, 1991, 1992, and we think that this is a very healthy development. Last year there was more—

Mr. RITTER. I think what you are basically saying is that you don't start a quality effort and apply for the Baldrige Award in one year.

Dr. REIMANN. No.

Mr. RITTER. When you look at the companies that won the awards, these were companies that were intimately involved in the quality movement long before the Baldrige Award was adopted.

What about the possibility of, at some point in the future, having a State award, sort of mini Baldrige awards in individual States? Is that what you are seeking to do with Connecticut and with California? Is there going to be a sufficient coordination? Is there going to be a lot of different principles out there, different application procedures? Are we going to be able to merge the two effectively?

Dr. REIMANN. You are getting at one of our main concerns of why we feel we ought to be involved in a coordination effort. We are fearful that there may be a proliferation of criteria and guidelines, and we feel that those communities can work with us in a partnership, and if there are needs for modification of criteria and so forth we can do it as a group and not go, you know, 51 different ways.

So far, we are encouraged by what we see. People are turning to us for advice and help.

Mr. RITTER. Should we be considering legislation to, if not mandate, but to ease the passage towards State level collaboration in quality awards, or should we be filtering this around for a while?

Dr. REIMANN. I think the mechanisms are in place to do it in the partnership mode that is occurring now. I think as the award becomes better known and the number of constituents we have who are familiar with the program begin to operate in their local communities, the word is getting out. So I think that the partnership approach is—I would say is indicated at this point.

Mr. RITTER. Okay. One last question.

Mr. ADAMS. Could I just make a brief statement in following?

Mr. RITTER. Sure.

Mr. ADAMS. What Dr. Reimann has said is true not only at the State level, but it gets right down to the municipality level. In our service territory in Florida, we probably have over 20 municipalities now who attend our facilitator training and have set up quality programs within their municipalities, dan the results, without exception, have been that their indicators are going in the right direction, that their quality of service is going up, their cost is going down, and their constituency is more satisfied, and the same within the State of Florida, the Department of Transportation is now participating in our program and other governmental agencies. So there is a great opportunity that you—

Mr. RITTER. I guess my point was, should we be encouraging—and, of course, we would have to provide the support for NIST if this were to happen—should we be encouraging an information outreach using the Baldrige Award and its spinoffs as a way to communicate with States and local governments to share information on the possibilities and the potential?

Right now, I guess they come to you. Maybe that is the best way to do it. You know, "I'm from the Federal Government, and I'm here to help" is something that is not very welcome any more, but—

Dr. REIMANN. Well, just on that last point, in the 18 to 20 months that we have been operating, there haven't been any shots

fired on the Government/industry cooperation. That is a surprise to us, and we are also making, I think, a forceful attempt to reach out by way of our boards. Our appointment to boards, among other things, reflect not only the competence of the people but also the communities that they represent, and we have an active effort through a newsletter and so forth to encourage people to make presentations and so on at the community and State and so on levels. So there is a very conscious effort, and to date that seems to be gaining momentum.

Mr. RITTER. That gets me to the last question. It seems to me that the publicity surrounding the quality revolution and the Baldrige Award is less than what one would expect. Can more be done to make the priority of this higher, to make the profile higher? I'm talking about the President, the White House, as well as the Secretary of Commerce, to really engage the media, the highest levels of the media, and all levels of the media, because, after all, if we look nationally as Federal legislators, we think culture change, we think attitude change, we think synergisms of all these pieces coming together where the whole is greater than the sum of its parts, and that is a communications effort.

My thought is, to be very honest with you, that, knowing what I know or what I believe about the importance of the Baldrige Award, that when the award was given, I didn't see it on the evening news or Good Morning, America, or on the front page of the Washington Post, New York Times, Wall Street Journal, L.A. Times; I didn't see it as a lead item in the AP wire; and I think we should work for that, I really do, to impact on the—do you have any ideas as to how to heighten the efforts there?

Dr. REIMANN. There was, I think, a good deal more media cultivation in 1988 than most people realize, and there has been a steady stream of information about the award since. So even though there was no big splash at the time of the award ceremony, I think thanks to the efforts of the winning companies and so many of our supporters—Corning Glass and so on—we have had a number of articles, including a very excellent article in today's Washington Post.

So I think it is—the prestige of the award, I believe, is going to attract the publicity. The publicity wasn't going to, in effect, create the prestige for the award. So I think the order is, in our judgment, a happy order, because now the award exists and has a constituency and a credibility, and so by the time it goes public the public will hear something that I think is credible.

Mr. ADAMS. Let me add to that, on April 4 we had a meeting here in Washington with the members of the Institute and the corporate communication directors from both Westinghouse and Motorola, because the directors and the trustees of the Foundation expressed the same concern you did, that they didn't think that there was sufficient recognition of the program and the winners and so forth.

So what we have done is form an ad hoc committee within the Foundation headed by a gentleman from McDonnell Douglas with the two representatives from Westinghouse and Motorola to work with the Institute and try to develop a better system of targeting, first, business editors; we at least should get tremendous coverage

from the business press; that is number one; and then, number two, to make it more significant and—you know, the confidentiality arrangement of that award process. The winners didn't know it until just a week before, and it didn't give them a lot of opportunity to gear up.

So we are trying to deal with an earlier recognition, and we do need some help at the White House to get confirmation of the award ceremony, the date and the time, so we can have earlier lead time and we can do a better job; you are absolutely correct.

Mr. RITTER. We will work with you.

I want to say that the President is very, very excited by this whole quality thing, and some of his key staffers really understand it in some detail—that is, for non-quality professionals; they do have an understanding of it.

Thank you, Mr. Chairman, and thank you, gentlemen, for the excellent job you are doing.

Mr. WALGREN. Thank you, Mr. Ritter.

The question of press reach and the like really goes to, in a way, how accessible the process or parts of it are to companies so it can be real in their own lives. You indicate, Dr. Reimann, that you feel that there are 50 to 100 organizations using the award guidelines for other purposes for every formal application that you see.

Dr. REIMANN. Yes.

Mr. WALGREN. How do you make that measure, and is there something that we should be encouraged to do to broaden the contact with the process that these companies are taking advantage of?

Dr. REIMANN. Well, we make the assessment through personal contact. People call us to tell us at meetings, and members of our boards number now about 150 people, report this either from their own companies or client companies and so on. Last year, for example, as the award became better known, we were disseminating applications long after the application deadlines and to groups that were not even eligible, to hospital and nonprofit groups and so on; they were being used in training. So we know that this ratio is about right of the 50 to 100 to one. Of course, we would love to see it be 500 to one or 1,000 to one, and I think we will live to see that day.

But I think that this is a process that is working now through a number of what I would call networks. We are trying to involve the trade and professional groups and area groups, and many of these are now picking up the theme and running with it, and the members of the Foundation, many of them, have pushed the quality effort through their suppliers, and that alone, in some cases, is a multiplier of 1,000 to one or 2,000 to one. So, for example, when FPL has its monthly seminars, they give copies to visitors and so on.

So we have many, many multipliers going on right now in a very voluntary kind of system, and I think we ought to see that take shape and report it to you. We are obliged to make a report after three years, and I think by then we will have a very good perception of how this networking effort is paying off.

Mr. WALGREN. Well, you should be encouraged in that, and we would, of course, be interested.

I guess I wonder whether there is some shorter form or perhaps not all encompassing sectioning of this interest that a company might be able to pick up and get involved with without thinking it is taking on the whole seven points, or whatever they are. I guess I am just wondering and ruminating about whether or not there are bits and pieces of these criteria that can be distributed widely and maybe more interesting as a finite section than the overall award.

I realize you are focused on making the awards, but at the same time whatever curriculum you have to teach the award or to pursue the whole award may be able to be segmented and made more interesting for people that aren't ready to apply for the whole.

Mr. ADAMS. If I could just respond from a corporate side, I think one of the problems that we have had is that people had bits and pieces of a quality program and thought they were there and were not realizing the benefits, and they were constantly modifying it or dropping it, starting something new. I think the guidelines and the requirements from our perspective, Florida Power and Light, that all elements are essential if you are going to teach and reach total quality control management systems.

Mr. WALGREN. Tell us about the service sector and why no awards were made in the service sector last year and how many applications you had from the service sector last year.

Dr. REIMANN. We had nine applications from the service sector, and while there were several, I think, quite good applications, they were not up to the level of the top applications in the other two categories, and I would say that the most fundamental concern we had was the fact that the service sector was not as fast on its feet in getting information out about the award.

So I think it is more a reflection of the speed with which the award was brought on stream than it is any fundamental flaw in service in the U.S. I believe that there are a number of good companies out there that are working toward it for 1989, 1990, and 1991, and that we will soon see an award in this area.

In Japan, I might note that the first service company award took 34 years into the process, and we think we can probably beat that by some.

Mr. ADAMS. Just an added comment. Manufacturing organizations have had the essence of some quality in their—through their quality assurance, Mr. Chairman, and most of them have been far ahead of the service industries, and that type of measurement, use of data, and expert analysis, and things of that nature. So the service industry can become just as competitive and win the award just as much as anyone else. All they have to do is become committed and understand it and do it.

Dr. REIMANN. Another quick comment on that, Mr. Chairman. Some of the better scoring applications in the service sector had gaps indicative of the fact that they did view quality in a narrower sense than these seven categories and that this process basically pinpointed those areas of weakness, and I think the companies are now moving forcefully in those directions. These are companies with very good reputations but just not up to the standard of the other winners in terms of being national models.

Mr. WALGREN. Of course, the other winners were in other areas. Somebody must be a national model in the service area.

Dr. REIMANN. Yes, but I think it is a question of how quickly some of the larger companies can prepare an application. Their communities were not as fast on their feet last year in getting the award information out, whereas organizations like the Machinery and Allied Products Institute and so on had major bulletins out on the award in the fall of 1987 to prompt manufacturing companies to take an interest. We didn't have that kind of support in the service sector.

Mr. WALGREN. I see.

You indicate, Dr. Reimann, that one of the key steps for 1989 was to make the examination more user friendly for service companies.

Dr. REIMANN. Yes.

Mr. WALGREN. What lies behind that?

Dr. REIMANN. Well, we wanted to make sure that there were no subtle barriers to applications to either small businesses or service businesses by using some of the language of the traditional quality assurance that had arisen out of the manufacturing category.

The sophisticated quality assurance people in the service industry said they had no difficulty with the translation, but they suggested that maybe some of the more beginning companies in the service area might have difficulty with that language. So we reached out to service communities and tightened up the language with respect to services, and I feel that we are now in very good shape for a balanced application for the three sectors.

Mr. WALGREN. You follow that on with saying that as a result of those changes the examination is being used more widely as a self-assessment tool.

Dr. REIMANN. Yes.

Mr. WALGREN. But we don't know that yet, do we?

Dr. REIMANN. Well, yes, because we have been disseminating those applications now since January, and many of the people order them by the, you know, 50 or 60 for training courses, for hospital administrators, and so on, and we feel that is—you know, we very often are told what the—

Mr. RITTER. Will the chairman yield on that?

Mr. WALGREN. I would be happy to yield.

Mr. RITTER. As I understand it, and as I mentioned in my opening statement, Motorola has now made a formal request to its suppliers, which must number in the thousands, to apply or begin applying—begin getting ready for a Baldrige Award application. Have you felt that wave of requests for—

Dr. REIMANN. Yes.

Mr. RITTER. That would relate to the chairman's question.

Dr. REIMANN. Yes, we have had more than a few phone calls on that subject. Yes, many companies are pointing to that, and, of course, Motorola stands ready to assist and advise these companies. But yes, we have had a step up in requests for materials, and Motorola has, of course, helped us disseminate that material.

Mr. RITTER. I think on the chairman's question, in addition to the Baldrige Award, the basic competitive challenge and the economics of this almost require companies that have gone to quality

to get their suppliers involved. It just doesn't make sense to do all the right things or attempt to do all the right things in your own shop if someone else is bringing in what is not nearly as high a level of quality. It has to be, and that is really what is happening in America today with companies that turn to quality; they are getting their suppliers involved.

Dr. REIMANN. Yes.

Mr. RITTER. And that is crucial.

I yield back to the chairman.

Mr. WALGREN. I thank the gentleman.

Dr. Reimann, we say we are distributing substantially more applications this year compared to last. Is this the total application they get, or are there other materials?

Dr. REIMANN. No. That is the total application, and from page 19 to 31 represents the award examination, and that is used as the self-assessment guide along with the scoring considerations on page 17, and that's the popular item that companies use.

Now some at the beginning stages—I know your concern expressed earlier regarding, what about beginners? Beginners don't need to worry about the 75-page application, they need to worry about understanding all of the items in those dozen or so pages, and they use it as a kind of checklist. They sit around the table and discuss the meaning of it and why it is important and why did our colleagues in—

Mr. WALGREN. I guess I am wondering if there is something that might give some life to some of the points in the application. As a nonbusinessman, I look at this, and it sort of stays on the page, it doesn't really come off the page with some kind of meaning to me, and I'm wondering whether there aren't some materials that perhaps might be developed in concert with this that would make the application more useful to the people that get it.

Dr. REIMANN. Yes. That is, I think, a major development that needs to be put in place now that we have what we believe are criteria that will begin to settle down. Between the first and second year, we had a number of major changes.

I also should add that we have a number of business school people, including a couple here today, who are concerned about the very points you raise and are interested in developing case materials that will also speak to the criteria and evaluation system, and in many ways we are most excited about that kind of development, because it not only penetrates a very important community, it gives us the very materials that we need to bridge the gap for the beginners that you have expressed a concern about.

Mr. RITTER. Mr. Chairman, could you yield on that for a second?

Mr. WALGREN. I would be happy to yield.

Mr. RITTER. Could you list some of those business schools?

Dr. REIMANN. Yes.

Mr. RITTER. You know, there is kind of a joke around here that certain business schools did more damage to the American economy than the Japanese could ever have dreamed of, and it is kind of nice to see that they are turning towards some of these more common sense approaches. But which business schools are actually doing this?

Dr. REIMANN. Well, we have some people from Harvard Business School, the University of Chicago, Illinois Institute of Technology, Southern California, and North Carolina, and the person joining us from North Carolina has very close associations with the American Assembly for Collegiate Schools of Business, which is the accrediting body for about 650 business schools, and they are interested in examining their curriculum from the point of view of how it treats quality. So this gentleman's involvement with us gives us a two-way street to that business school community.

Mr. RITTER. I think that is terrific, Mr. Chairman, because to date there has been a decided vacuum. The private sector has been out there doing some of these things, and I guess business schools being tenured up and having their existing programs going on have done precious little to contribute to this quality revolution, and I am delighted to hear that there is something going on out there. That is great.

Thank you, Mr. Chairman.

Mr. WALGREN. You indicate also, Dr. Reimann, that one of the difficulties was getting the feedback back to the companies because of the logistics of getting the examiners together, and the examiners, I gather, are volunteers. Is that right?

Dr. REIMANN. They are volunteers or work for honoraria at a small fraction of what their normal pay would be.

Mr. WALGREN. But that is a pretty important part of the program.

Dr. REIMANN. Yes, it is.

Mr. WALGREN. It is the real value, as I would understand it, to a participating company that they are after, and if we have difficulty doing that we are going to have difficulty delivering the value to the companies for participating. Is that correct?

Dr. REIMANN. Yes. We anticipate a strengthening of that process this year and also moving it up so that feedback will be better and earlier, but it does place a very great demand on the volunteer effort that goes into this program.

So we are really heavily indebted to the tremendous quality and dedication of the examination team that we were lucky enough to get this past year.

Mr. WALGREN. And you have increased the fees to manufacturing and to service companies in the application this year.

Dr. REIMANN. Yes.

Mr. WALGREN. And yet you feel the fees are really not a barrier at this point to participation.

Dr. REIMANN. Not really. The fee to participate is a small fraction of the fee that it takes to actually prepare an application, and in the thousands of calls and letters we get per year I would say that a tenth of a percent or fewer ever deal with the fee issue. So it really isn't a big issue, and our board of overseers actually encouraged a fee somewhat larger than the one we invoked this year. They feel it is a bargain to get this quality. The level of the people who are working on this program is so much above the level of the average quality assurance professional that the feedback is worth a great deal at market rates.

Mr. WALGREN. I see.

Well, you have obviously got a going thing going, and you deserve a lot of credit for that, and we hope that this year will be a very good one for you and that you will have lots of experience starting to build up with this effort, and I want to encourage you, too, to keep looking for ways, as I am sure you will, that it can be enhanced and given greater reach. I wouldn't like to see us stop our fund-raising, for example, if there were some bit of effort that could be added to the system that would make it reach substantially farther, and I think we ought to be sure at all times that we are not starting to curtail the reach of the program in any way, and obviously I am sure you feel that deeply, too.

Mr. ADAMS. Just a brief response. The trustees have indicated if the program requires more money, they will provide it.

Mr. WALGREN. Okay. Well, you have got some good angels there. Well, all right. Well, thank you all very much. We appreciate your coming today and appreciate your being a resource to us and look forward to talking to you as the year goes along.

Dr. REIMANN. Thanks very much.

Mr. ADAMS. Thank you very much.

Mr. WALGREN. Thank you very much.

The next panel is made up of representatives of those who were so successful in last year's competition, the three winning companies. From Motorola comes Richard Buetow, the vice president and director of quality; from Globe Metallurgical, Incorporated, Ken Leach, the vice president of administration; and from Westinghouse Electric Corporation, the Commercial Nuclear Fuels Division, Mead D'Amore, the general manager of that division.

Welcome, gentlemen. We appreciate your coming and look forward to having you give us a survey of your involvement with this program, and what you think its benefits have been, and how you have responded to it, and what advice you would like to give it.

So why don't I invite you to give statements in the order in which I introduced you to the record, and we will start with Mr. Buetow.

STATEMENTS OF RICHARD BUETOW, VICE PRESIDENT AND DIRECTOR OF QUALITY, MOTOROLA, INC., SCHAUMBURG, ILLINOIS; KENNETH E. LEACH, VICE PRESIDENT OF ADMINISTRATION, GLOBE METALLURGICAL, INC., BEVERLY, OHIO; AND MEAD D'AMORE, GENERAL MANAGER, COMMERCIAL NUCLEAR FUEL DIVISION, WESTINGHOUSE ELECTRIC CORPORATION, MONROEVILLE, PENNSYLVANIA

Mr. BUETOW. Okay, Mr. Chairman. Thank you very much.

Today I'd like to talk about Motorola's Six Sigma Quality Program and what it means to our company, our customers, our communities, and our future as a Nation.

Six Sigma, a statistical term, means that we approach perfection in everything we do. It means that the quality improvement process will continue to be our foremost operational initiative. We have been stressing this program for a long time, but in November of last year it took on a new meaning. We won the first Malcolm Baldrige National Quality Award. We are one of three winners and the only major corporation to win it on a company-wide basis. It

recognizes our initiatives in managing and improving quality processes, products, and services. This has been a tremendous honor for us and a tribute to the 100,000 Motorola people world-wide who continue to make quality a reality through their constant dedication and daily actions.

We applaud the Government's decision to establish this award. It highlights a critical issue for industrial America. As we improve the quality of American-made products and services, we are strengthening our ability to compete. We are gaining share in global markets and renewing our Nation's economy.

We are proud of winning the award, but at the same time we know the pitfalls of euphoria. Quality is a moving target, and a leader that rests on its laurels doesn't remain a leader. The Malcolm Baldrige Award recognizes our process for managing quality as well as the progress that we have made thus far. It is an endorsement of our efforts to date and confirms that we are on the right track.

Motorola's driving thrust is renewal. In the rapidly changing world of electronics, that is the only way to survive. In our 60-year history, we have completely transformed ourselves at certain crucial times. In 1974, for example, we sold our television business to concentrate on high technology electronics. Today, we are the world leaders in two-way radio communications, paging, cellular telephone equipment and systems, modems, and many parts of the semiconductor industry.

About a decade ago, we were enjoying healthy growth, but we were also aware that a number of our customers were dissatisfied with the quality of some of our products and services. A few of our competitors were outperforming us. We realized that we had to renew ourselves again and set higher levels of expectation for our improvement efforts.

In 1981, we set a goal that appeared to be impossible, a tenfold improvement in quality in five years. We also sharpened our focus on the customer. We largely achieved our initial goal of tenfold improvement in quality in five years only to discover that the goal hadn't been ambitious enough.

In January 1987, Bob Galvin, our chairman, stated our new quality goal in a message to all employees: Improve product and services quality an additional ten times by 1989 and at least one hundredfold by 1991, and achieve Six Sigma capability by 1992. With a deep sense of urgency spread dedication to quality to every facet of the corporation and achieve a culture of continual improvement to assure total customer satisfaction. There is only one goal—zero defects—and that is in everything we do. And that goal was a result of some very significant benchmarking that we did throughout the world, very specifically in the Far East, and what we found was that the average company—and there's an awful lot of average companies—are producing products at defect levels that run a thousand times higher than best in class.

We are often asked what is Six Sigma, and with total customer satisfaction as our fundamental objective we launched five key initiatives, the first of which is Six Sigma quality, and in statistical terms this translates into a defect rate of 3.4 parts per million for each and every process step or procedure. The goal is aimed at the

products we make, the processes, equipment, and the materials we use, and the procedures and the systems we employ.

Our Six Sigma program focuses on reducing the variation from the mean or the desired result of any process or procedure. This variation from the mean in statistical terms is measured in standard deviations or sigma. Historically, acceptable variation or process with has been plus or minus 3 sigma from the mean, and with 3 sigma capability about 2,700 parts per million each process step will fall outside control limits or specifications; they are simply defective.

A number of years ago, that would have been considered excellent, but with the advancements in technology, rising customer expectations, and the global nature of competition, this is no longer acceptable; perfection is and has to be the goal.

We, Motorola, have a detailed road map for achieving Six Sigma capability by 1992. Internally, we are participating much more closely in defining common goals and capabilities and working together throughout the design, development, and production ready phases.

In 1988, Motorola achieved $8.25 billion in sales. By implementing the Six Sigma methodology, Motorola in 1989—this year—will spend $250 million less in quality-related costs as a result of the improvements achieved in just the last two years. In addition, the new products introduced yield field reliability improvements of three to ten times, and it is a testimonial that quality truly is free.

The Baldrige Award is designed to help U.S. companies share information about quality and encourage greater awareness of the importance of quality in global competitiveness. As a winner, we are eager to explain our quality program in details. In fact, since the first of this year my phone has not stopped ringing. We have been contacted—and in the submission I said 170 customers; it is 205 as of yesterday—for details on our Six Sigma quality improvement process, and we have sent them the requested information.

We have had representatives from over 20 of the Top 100 companies in America spend a day in one of our facilities studying our program. One company has been back three times. Additionally, each month we hold a quality briefing day for any company that wishes to send one or more representatives. The briefings last about five hours. We have had so many requests that we now must schedule companies for briefings in the second half of this year. Our corporation has already committed its senior executives to over 60 major speaking engagements on the subject of quality in 1989, and it is only April.

At the beginning of this decade, Motorola set out to meet Japan's challenge. We have succeeded, and today we are gaining share in markets throughout the world. In Japan, for example, we are the only non-Japanese company to supply pagers to Nippon Telegraph and Telephone. We exceeded their quality and reliability requirements. In fact, our pager has a mean time between failure of more than 100 years. Today, Motorola has the largest share of the paging market in Japan, and our Japan pager is manufactured in Boynton Beach, Florida, U.S.A.

We have much the same story in our cellular telephone business. In our mobile car phone operation, we have achieved a 30 to one

reduction in factory cycle time, a 90 percent reduction in defects per unit, reduced parts counts by 62 percent, and have achieved a 10 to one improvement of field reliability. We have the world's largest market share in this product, and the majority of these units are manufactured in Arlington Heights, Illinois, U.S.A.

The quality culture at Motorola is pervasive. The principles extend to everything we do; they affect the way we approach our jobs, the way we feel about ourselves, and the way we treat our suppliers and customers both inside and outside our organization, and it was talked about earlier, we have laid down the gauntlet to our suppliers, and we will encourage and participate with them to go after the Baldrige Award and go through the process necessary to achieve it.

An interesting footnote of a Baldrige Award is that all three winners were manufacturing companies; no one in the service category. This is America's next big challenge, to apply the lessons of manufacturing quality to service industries both in the public and private sector. Our own visits with customers confirm what we have read in the mass media. People complain far more about breakdowns in service than about product quality. These complaints come at a time when more competition is coming from abroad. Japanese banks and investment firms are growing rapidly in global financial markets; Japan is investing heavily in services; and, as our chairman pointed out almost two years ago, service industries hold the key to global economic leadership; and Japan is strategically poised to achieve that position.

Our focus on quality is crucial to our survival and future success. We are off to a good start. The potential awards are enormous. A culture that is dedicated to quality will result in more profitable companies and industries, a stronger nation, and a better world, and it is worth the effort.

Thank you.

[The prepared statement of Mr. Buetow follows:]

MOTOROLA INC.

1988 Winner

Malcolm Baldrige
National
Quality
Award

SIX SIGMA
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The Renewal of Quality

Introduction

Thank you. Today I'd like to talk about Motorola's Six Sigma Quality Program, and what it means to our company, our customers, our communities and our future as a nation. We've been stressing this program for a long time, but in November, it took on a new meaning. We won the first Malcolm Baldrige National Quality Award, the American equivalent of the Nobel Prize for quality. We were one of three winners, and the only major corporation to win it on a company-wide basis. It recognizes our initiatives in managing and improving quality processes, products and services.

This has been a tremendous honor for us--and a tribute to the 100,000 Motorola people worldwide, who continue to make quality a reality through their constant dedication and daily actions.

The award was established in 1987, and named after the late secretary of commerce. Its purpose is to promote quality awareness, recognize the achievements of U.S. companies and publicize successful quality strategies. Our application covered our quality system in such categories as corporate leadership, strategic quality planning, human resources and customer satisfaction. Applications were scored, reviewed and judged by industry experts who served as examiners.

The American Society for Quality Control and the American Productivity Center administered the process.

We applaud the government's decision to establish this award. It highlights a critical issue for industrial America: As we improve the quality of American-made products and services, we are strengthening our ability to compete. We are gaining share in global markets and renewing our nation's economy.

We are proud of winning the award, but at the same time, we know the pitfalls of euphoria. Quality is a moving target, and a leader that rests on its laurels doesn't remain a leader. The Malcolm Baldrige Award recognizes our process for managing quality as well as the progress we have made thus far. It is an endorsement of our efforts to date and confirms that we are on the right track. But we have a long way to go to reach our goal of Six Sigma Quality by 1992. Six Sigma, a statistical term, means that we approach perfection in everything we do. It means that the quality improvement process will continue to be our foremost operational initiative.

History

Motorola's driving thrust is renewal. In the rapidly changing world of electronics, that's the only way to survive. In our 60-year history, we have completely transformed ourselves at certain crucial times. In 1974, for example, we sold the television business to concentrate on high-technology electronics. Today we are world leaders in two-way radio communications, paging, cellular telephone

equipment and systems, modems, and many parts of the semiconductor industry.

About a decade ago, we were enjoying healthy growth, but we also were aware that a number of our customers were dissatisfied with the quality of some of our products and services. A few of our competitors were outperforming us. We realized that we had to renew ourselves again and set higher levels of expectation for our improvement efforts. In 1981, we set a goal that appeared to be impossible--a 10-fold improvement in quality in five years. We also sharpened our focus on the customer.

The culture changed. At meetings of the Operating and Policy committees, a review of our quality program became the first item on the agenda. We launched a landmark campaign called "Meeting Japan's Challenge" to put quality high on the national agenda. It included advertising, public relations, management speeches, employee communications, and position papers on quality.

We established regular quality system reviews of all operations. We reorganized and we integrated related functions. We developed training courses to teach quality technology at all levels of the company. We learned how to improve the design of products for manufacturability and increased customer satisfaction.

In 1986, Bob Galvin, our chairman, began a more formal program of customer visits. These visits traditionally had been less

systematic and covered only specific topics. Under the new program, we started talking to customers at various levels of their business. We asked two basic questions: What do you like about Motorola, and what don't you like? After each visit, a detailed report with specific recommendations was submitted. These visits have become so important that they have been made a permanent procedure, and extended to involve all officers. The visits have become part of our quality culture and have resulted in a reformulation of our basic goals and objectives. We later expanded the concept to supplier visits.

We largely achieved our initial goal of a 10-fold improvement in quality in five years, only to discover that the goal hadn't been ambitious enough. In January 1987, Bob Galvin stated our new quality goal in a message to all employees:

> "Improve product and services quality ten times by 1989, and at least one hundred fold by 1991. Achieve Six Sigma capability by 1992. With a deep sense of urgency, spread dedication to quality to every facet of the corporation, and achieve a culture of continual improvement to assure total customer satisfaction. There is only one ultimate goal: zero defects -- in everything we do."

What is Six Sigma?

With total customer satisfaction as our fundamental objective, we launched five key initiatives, the first of which is Six Sigma Quality. In statistical terms, this translates into a defect rate of 3.4 parts per million for each and every process step or procedure. The goal is

aimed at the products we make, the processes, equipment and materials we use, and the procedures and systems we employ.

Our Six Sigma program focuses on reducing the variation from the mean, or desired result, of any process or procedure. This variation from the mean in statistical terms is measured in standard deviations, or sigma. Historically, acceptable variation, or process width, had been plus or minus three sigma from the mean. With three sigma capability, about 2,700 parts per million (or 2.7 parts per thousand) in each process step will fall outside the control limits or specification. They're defective. A number of years ago, that would have been considered excellent, but with the advancements in technology, rising customer expectations and the global nature of competition, this is no longer acceptable. Perfection is the goal!

If you look at the cumulative effect of defects on a multiple-step process, you can see a dramatic difference. With three sigma capability, a final product containing 100 process steps or parts would have a cumulative yield of just one-tenth of 1%. At Six Sigma, the yield jumps to more than 99.9%. These figures allow for the expected change a process experiences with factors like time.

Given that kind of improvement, you can see why we are so excited about Six Sigma. We have a detailed roadmap for achieving this goal by 1992. We are participating much more closely in defining common goals and capabilities, and working together throughout the design, development and production-ready phases.

The Baldrige Award is designed to help U.S. companies share information about quality and encourage greater awareness of the importance of quality in global competitiveness. As a winner, we are eager to explain our quality program in detail.

It begins with training; it is one of the soundest investments you can make. We spend more than $45 million each year to provide one million hours of training for our employees. Courses range from basic reading and math skills to highly technical seminars. The half life of the knowledge of a new engineer is about seven years. When half of your expertise becomes obsolete every seven years, you spend lots of time on continuing education. Our Six Sigma program is about change, and education is one of the best agents of change.

Forty percent of our training is devoted to quality improvement processes, principles, technology and objectives. The students include assembly operators, technicians, engineers, salespeople, support groups and management.

One of our first efforts in quality education has become one of the most successful. It is the Motorola Management Institute, an intensive two-week program in world-class design, manufacturing and quality issues for managers at both senior and support levels. The course emphasizes how all functions, including design, engineering, manufacturing and marketing, work together to reduce cycle times and improve quality. The two-week institute has inspired some of our

most exciting breakthroughs. One of our facilities in Florida now turns out custom-made pagers in minutes instead of weeks. Our programs in "Statistical Process Control," "Design for Manufacturability" and "Understanding Six Sigma" complement MMI, and are geared to enable the entire corporation to reach its quality goals.

"Understanding Six Sigma" is the basic course designed for all employees. It goes through six steps that provide a very basic, common-sense approach to how individuals and businesses do their jobs, as well as the techniques employed in the quality improvement process.

The first step is to identify the product you create or the service you provide. "You" can refer to a department, an operation, a group, a team or an individual employee. Step Two is to identify the customers for your product or service and determine what they consider important. They can be external customers or people within your organization. The third step is to identify what you need to provide a product or service that satisfies the customer. Once you have determined this, you can sit down with your suppliers and tell them what you will need as you improve the way you do your work.

Step Four is to define the process for doing your work. This means breaking down operations into steps and tasks, and identifying detailed inputs and outputs for each. You build flowcharts, spot tasks that are prone to error, and measure the defect rate and cycle time.

In Step Five, you design the process so it is mistake-proof, and you eliminate wasted effort. To reduce the likelihood of error, you can simplify tasks, increase training or change methodologies. If a task adds no value, you throw it out.

The final step is to ensure continuous improvement by measuring, analyzing and controlling the improved process. This involves tracking and recording cycle time, counting defects and calculating sigma levels.

This process applies to everything we do. It means a total dedication to quality in every facet and discipline of our business, such as service, order entry, accounting--each and every function of our business. It shows how suppliers and customers depend on each other. For example, we have held quality-improvement seminars for our travel suppliers, including car rental and travel agencies, hotels and motels. These service businesses can analyze each function, break them down into repetitive processes and correct them to work in all situations.

Five Initiatives for Customer Satisfaction

I said earlier that Six Sigma Quality was the first of five key initiatives to achieve Total Customer Satisfaction. The other four are closely related to quality. Our second initiative is Total Cycle Time Reduction. One definition of cycle time is the elapsed time from the moment a customer places an order for an existing product to the

time we deliver it. In the case of a new product, it is from the time we conceive of a new product to the time it is shipped.

If you think this is a new concept, remember that 60 years ago, Henry Ford could turn iron ore into a finished car in less than 48 hours. The term "renewal" suggests that we're rediscovering where we as a nation have been before.

Cycle time management is based on the simple notion that time is money. In an industry as competitive as ours, experience curves are extremely steep, and shipping a new product late results in sharply lower profitability.

That leads us to our third initiative, achieving product and manufacturing leadership. We put these two disciplines together to emphasize the need to work together. In our Cellular Group, for example, design and manufacturing people worked together to develop the Mini-TAC car telephone. Built in a focused factory in Arlington Heights, Ill., it has 70% fewer components than earlier models. Cycle time has been reduced by 30-to-1, and reliability has improved by 10 to 1. The Mini-TAC competes successfully in price and quality throughout the world.

Our fourth initiative is our Profit Improvement Program. This is not a conventional, short-term cost-cutting effort. It is a long-term, customer driven approach that shows us where to commit our resources today to achieve long-term growth. It also recognizes that

even a leadership company like ours still wastes about 10% of sales in the production and distribution process due to less-than-perfect quality. Our Six Sigma campaign has enormous profit potential.

Our fifth initiative is to enhance our participative and cooperative cultures. This means working better and more cooperatively with suppliers, across functions and across organizations, to serve our customers. This approach is resulting in less duplication and more efficiency, but its greatest long-term benefits will come as we improve the total way we serve the customer.

These five initiatives form a comprehensive, long-term strategy for Motorola. They constitute a restructuring, a renewal, and a complete transformation of the way we do business. At the same time, all five initiatives are directly related to some very basic concepts that are at the core of our Six Sigma Quality program.

Conclusion

At the beginning of this decade, Motorola set out to meet Japan's challenge. We succeeded, and today we are gaining share in markets throughout the world. In Japan, for example, we are the only non-Japanese company to supply pagers to Nippon Telegraph & Telephone. We exceeded their quality and reliability requirements; in fact, our pager has a mean time between failure of about 100 years. [Efforts like these are absolutely essential if America is to assert and maintain global leadership.]

The quality culture at Motorola is pervasive. The principles extend to everything we do. They affect the way we approach our jobs, the way we feel about ourselves, and the way we treat our suppliers and customers, both inside and outside our own organization.

An interesting footnote to the Baldrige awards is that all three winners were manufacturing companies. Nobody won in the service category. This is our next big challenge, to apply the lessons of manufacturing quality to service industries, both in the public and private sectors. Our own visits with customers confirm what we read in the mass media. People complain far more about breakdowns in service than about product quality. These complaints come at a time when more competition is coming from abroad. Japanese banks and investment firms are growing rapidly in global financial markets. Japan is investing heavily in services. As Bob Galvin pointed out almost two years ago, service industries hold the key to global economic leadership, and Japan is strategically poised to achieve that position.

Our focus on quality is crucial to our survival and future success. We have a long way to go, but we're off to a good start. The potential rewards are enormous. A culture that is dedicated to quality will result in more profitable companies and industries, a stronger nation and a better world. It's worth the effort.

Thank you.

MOTOROLA INC.

THE FOLLOWING IS .....

A SYNOPSIS IN GRAPHIC FORM OF OUR 6 SIGMA THRUST TO ACHIEVE

TOTAL CUSTOMER SATISFACTION

MOTOROLA CORPORATE INITIATIVE

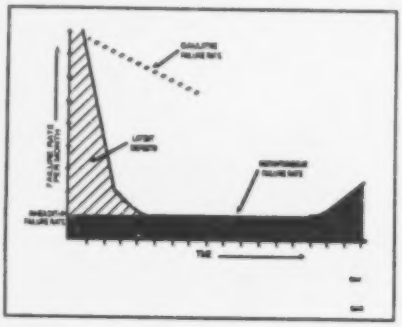
Six Sigma Thrust

10X in 2 Years

100X in 4 Years

Six Sigma Capability by 1992

BETWEEN 1981 AND 1986, WE LARGELY ACHIEVED OUR INITIAL GOAL OF A 10X IMPROVEMENT IN QUALITY IN FIVE YEARS ONLY TO DISCOVER THAT THE GOAL HADN'T BEEN AMBITIOUS ENOUGH. IN JANUARY 1987, OUR CHAIRMAN STATED OUR NEW GOAL.



A PRODUCT'S INHERENT FAILURE IS VERY IMPORTANT AND EACH NEW GENERATION OF PRODUCT SHOULD HAVE A SIGNIFICANT IMPROVEMENT OVER WHAT IT REPLACED. LATENT DEFECT CONTENT, THE LEADING EDGE OF THE CURVE, CAUSES EARLY LIFE FAILURES AFTER THE PRODUCT IS DELIVERED AND PLACED INTO CUSTOMER SERVICE. THESE EARLY LIFE FAILURE FORM THE CUSTOMER'S PERCEPTION OF PRODUCT RELIABILITY.

LATENT DEFECTS . . .

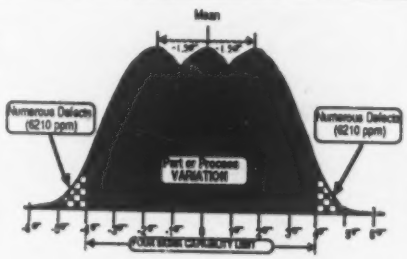
Directly Related to the Number of Defects Repaired in the Manufacturing Process

OUR STUDIES HAVE SHOWN THAT THE THE LEVEL OF LATENT DEFECT IN A SHIPPED PRODUCT IS ····

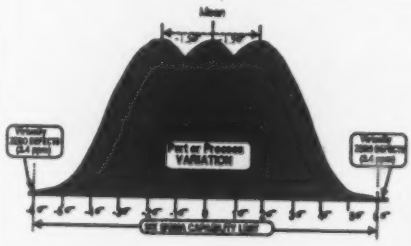
DEFECTS IN THE MANUFACTURING PROCESS ARE CAUSED BY...

- Insufficient Manufacturing Process Control
- Design Margin
- Bad Material

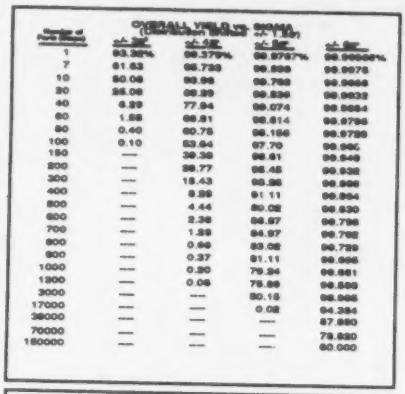
CAUSE OF DEFECT'S....



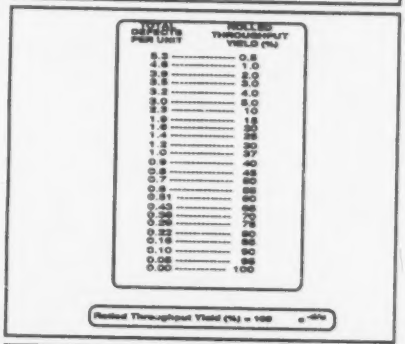
FOUR SIGMA CAPABILITY CAUSES DEFECT'S TO OCCUR AT A 6210 PPM RATE WITH MEAN SHIFT'S OF + OR - 1.5 SIGMA. WE HAVE CHOSEN MEAN SHIFTS OF + OR - 1.5 SIGMA AFTER MUCH EMPIRICAL STUDY.



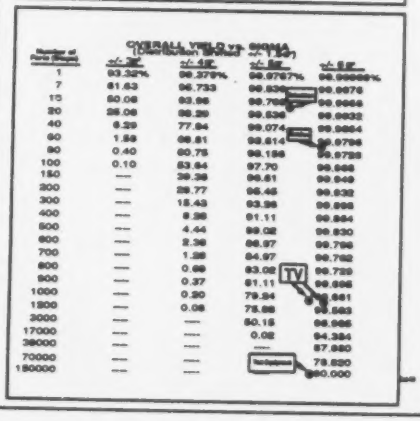
SIX SIGMA CAPABILITY CAUSES DEFECT'S TO OCCUR AT 3.4 PPM RATE WITH MEAN SHIFT'S OF + OR - 1.5 SIGMA. *THE DEFECT RATE BEGINS TO APPROACH ZERO.*



WE DEVELOPED A CHART BASED ON 3,4,5, & 6 SIGMA CAPABILITY TO SEE THE EFFECT OF SIGMA CAPABILITY ON THE PROBABILITY OF BUILDING A PRODUCT OF VARYING COMPLEXITY AND ITS ABILITY TO BE MANUFACTURED WITHOUT REPAIR DURING THE MANUFACTURING PROCESS.



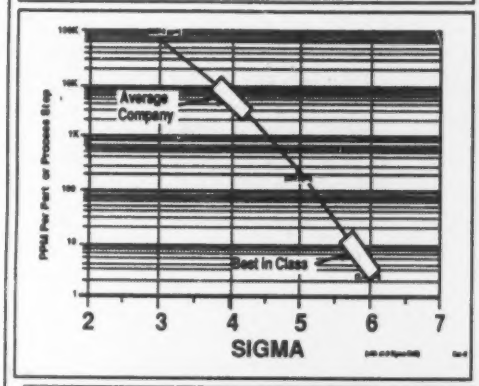
DEFECTS PER UNIT OF WORK IS THE INDEPENDENT VARIABLE IN THE QUALITY IMPROVEMENT PROCESS. ROLLED YIELD IS THE RESULT OF DEFECTS.



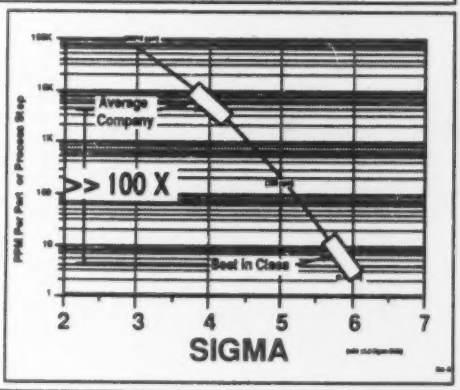
HERE IS SOME BENCHMARK DATA ON A FEW BEST - IN - CLASS COMPANIES. WITH 1000 +, PARTS OR PROCESS STEPS. ONLY A FEW SETS OUT OF A THOUSAND BUILT WILL NEED REPAIR DURING MANUFACTURE.

Number of Parts or Process Steps	+/- 3σ	+/- 4σ	+/- 5σ	+/- 6σ
1	93.32%	99.379%	99.9767%	99.99966%
7	61.66	95.73	99.836	99.9976
10	50.08	95.96	99.768	99.9966
20	25.08	92.09	99.539	99.9932
40	6.29	77.94	99.074	99.9864
60	1.58	68.91	98.614	99.9796
80	0.40	60.7	98.156	99.9728
100	0.10	53.94	97.70	99.966
150	----	39.38	96.61	99.949
200	----	28.77	95.46	99.932
300	----	15.43	93.26	99.898
400	----	8.28	91.11	99.864
500	----	4.44	89.02	99.830
600	----	2.38	86.97	99.796
700	----	1.28	84.97	99.762
800	----	0.69	83.02	99.728
900	----	0.37	81.11	99.695
1000	----	0.20	79.24	99.661
1500	----	0.06	73.58	99.559
3000	----	----	60.18	99.355
17000	----	----	0.02	94.384
38000	----	----	----	97.880
70000	----	----	----	79.820
150000	----	----	----	60.000

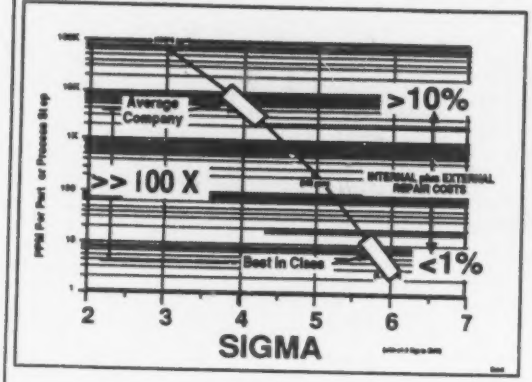
HERE IS WHERE MOST COMPANIES FALL ON THE CHART. IF YOU DO NOT MANAGE EACH PART OR PROCESS REQUIREMENT TO VIRTUAL PERFECTION , DEFECTS ARE CREATED AND THEY MUST BE FOUND AND REPAIRED.



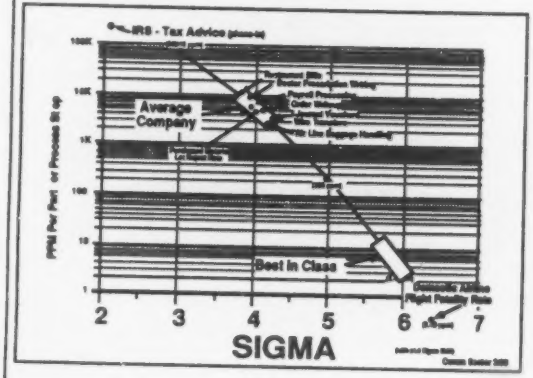
THIS CHART RE-WORKS THE DATA ON THE ABOVE CHART. WE FOUND VERY FEW COMPANIES IN 1986 THAT BUILT PRODUCT BETWEEN 4 & 6 SIGMA.



THE CONCLUSION IS THAT 6 SIGMA PERFORMERS , HAVE DEFECT LEVELS DURING MANUFACTURE,THAT ARE TWO TO THREE ORDERS OF MAGNITUDE LESS THAN AVERAGE PERFORMERS.



THERE ARE FINANCIAL IMPLICATIONS AS WELL. A 4 SIGMA MANUFACTURE WILL SPEND IN EXCESS OF 10 % OF THE SALES DOLLAR ON INTERNAL AND EXTERNAL REPAIR. A 6 SIGMA MANUFACTURE WILL SPEND LESS THAN 1 %. A 4 SIGMA SUPPLIER CANNOT DIRECTLY COMPETE WITH A 6 SIGMA SUPPLIER AND SURVIVE.



CAN WE BENCHMARK NON-MANUFACTURING ON THE SAME CHART? YES ! WE PLOTTED SOME DATA THAT IS IN THE PUBLIC DOMAIN AS WELL AS SOME INTERNAL DATA TAKEN IN 1986. FOR THE MOST PART THE HUMAN ERROR RATE IS ABOUT 4 SIGMA. HOWEVER AIRLINE SAFETY IS ABOVE 6 SIGMA. IT IS A WELL MANAGED SYSTEM, INCLUDING EQUIPMENT.

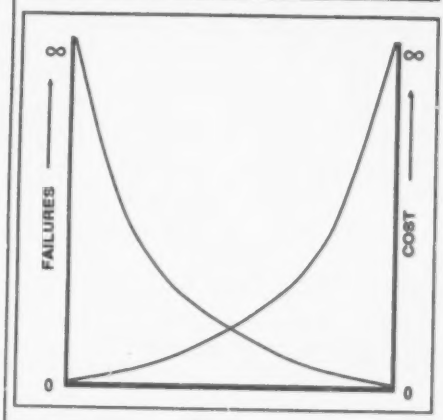
- Hire Good People
- Capital Investment
- Financial Incentives

THIS IS WHAT WE ALL TRY TO DO • • • •

AND

SEE NEXT PAGE

4 Sigma Performance

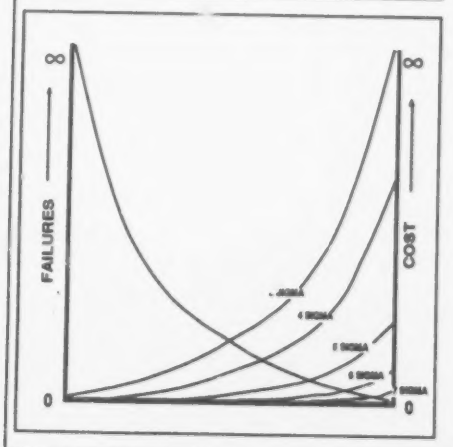


THIS IS WHAT YOU GET!!

YOU MUST MANAGE THE PROCESS TO VIRTUAL PERFECTION TO GET TO 6 SIGMA AND BEYOND.

THE " OLD " SCHOOL TAUGHT IMPROVING QUALITY COST MONEY! IT WAS PRUDENT TO SHIP SOME DEFECTS IT SAVED MONEY!

NOT TRUE • • • •



IMPROVING SIGMA CAPABILITY IN BOTH PRODUCT AND PROCESS RESULTS IN A PRODUCT WHICH IS VIRTUALLY LATENT DEFECT FREE, AND IT RESULTS IN THE LOWEST MANUFACTURING COST.

OUR FUNDAMENTAL OBJECTIVE
(EVERYONE'S OVERRIDING RESPONSIBILITY)

FOR

TOTAL CUSTOMER SATISFACTION

KEY BELIEFS—*HOW WE WILL ALWAYS ACT*
- Constant Respect For People
- Uncompromising Integrity

KEY GOALS – *WHAT WE MUST ACCOMPLISH*
- Increased Global Market Share
- Best In Class
  - PEOPLE
  - MARKETING
  - TECHNOLOGY
  - PRODUCT
  - MANUFACTURING
  - SERVICE
- Superior Financial Returns

KEY INITIATIVES – *HOW WE WILL DO IT*
- Six Sigma Quality
- Total Cycle Time Reduction
- Product and Manufacturing Leadership
- Profit Improvement
- Participative Management Within and Cooperation Between Organizations

THESE ARE MOTOROLA'S GOALS.

THEY ARE OUR ONLY GOALS.

TOTAL CUSTOMER SATISFACTION

REQUIREMENTS

- TOP DOWN COMMITMENT AND INVOLVEMENT

  SET THE EXAMPLE, BE ACTIVE IN THE AUDIT PROCESS
- MEASUREMENT SYSTEM TO TRACK PROGRESS

  AT BOTH MACRO AND MICRO LEVEL
- TOUGH GOAL SETTING (REACH OUT !!)

  BENCHMARK BEST- IN - CLASS
  AUDIT OFTEN
- PROVIDE THE REQUIRED EDUCATION

  THE WHY AND HOW TO
- SPREAD THE SUCCESS STORIES
- SHARE FINANCIAL IMPROVEMENT GAINS WITH THOSE WHO CONTRIBUTED

WE ARE OFTEN ASKED WHAT WE BELIEVE TO BE KEY INGREDIENTS FOR A COMPANY TO RENEW ITSELF AND CHANGE IT'S CULTURE , TO STRIVE TO BE BEST- IN - CLASS AND APPROACH THE GOAL OF TOTAL CUSTOMER SATISFACTION ? THE CHART ON THE LEFT IS NOT ALL INCLUSIVE BUT MOST ARE BASIC REQUIREMENTS FROM OUR POINT OF VIEW.

Six Steps to Six Sigma
(Manufacturing)

- IDENTIFY PRODUCT CHARACTERISTICS NECESSARY TO SATISFY CUSTOMER PHYSICAL AND FUNCTIONAL REQUIREMENTS
- CLASSIFY IDENTIFIED CHARACTERISTICS AS:
- DETERMINE WHETHER CLASSIFIED CHARACTERISTIC IS CONTROLLED BY:
- DETERMINE MAXIMUM ALLOWABLE TOLERANCE FOR EACH CLASSIFIED CHARACTERISTIC WHICH STILL GUARANTEES SUCCESSFUL PERFORMANCE
- DETERMINE PROCESS VARIATION FOR EACH CLASSIFIED CHARACTERISTIC
- CHANGE DESIGN OF PRODUCT, PROCESS, OR BOTH TO ACHIEVE Cp EQUAL TO, OR GREATER THAN 2

SIX SIGMA

6σ

MOTOROLA

UNDERSTANDING 6 SIGMA

IN A NON - MANUFACTURING ENVIRONMENT

- Every Organization Exists To Do
- What It Does Is Its Product
- For Whom It Does Is Its Customer
- In Order To Do, It Has Needs
- Its Needs Are Its Supplies
- Providers Of Needs Are Its Suppliers
- One Man's Needs Is Another Man's Do
- Each Do/Need Pair Is An Interaction
- Every Controlled Process Is A Closed Loop Of Interactions

SIX STEPS TO SIX SIGMA

(Non- Manufacturing)

1. IDENTIFY THE PRODUCT YOU CREATE OR THE SERVICE YOU PROVIDE.
2. IDENTIFY THE CUSTOMER(S) FOR YOUR PRODUCT OR SERVICE, AND DETERMINE WHAT THEY CONSIDER IMPORTANT.
3. IDENTIFY YOUR NEEDS (TO PROVIDE PRODUCT/ SERVICE SO THAT IT SATISFIES THE CUSTOMER).
4. DEFINE THE PROCESS FOR DOING THE WORK.
5. MISTAKE-PROOF THE PROCESS AND ELIMINATE WASTED EFFORT.
6. ENSURE CONTINUOUS IMPROVMENT BY MEASURING, ANALYZING, AND CONTROLLING THE IMPROVED PROCESS.

1988 Winner

Malcolm Baldrige National Quality Award

RICHARD C. BUETOW
Corporate Vice President
Motorola Director of Quality

Richard Buetow is corporate vice president and Motorola director of quality for Motorola, Inc., Schaumburg, Ill. He began his career with Motorola in 1958 as an electronic design engineer in the Communications Sector. He later become manager of engineering for mobile products, chief engineer for base station products, and product manager for portable products.

In 1971 Richard was appointed director of product operations for the Communications Sector in Europe. He became operations manager for mobile products in 1974 and general manager of Mobile Products Division in Fort Worth, Texas, in 1979. He was named director of technical assets for the Communications Sector in 1983 and sector director of quality assurance in 1985. He became a corporate vice president in 1986 and assumed his present position in January, 1989. In his present position, Buetow is in charge of Motorola's worldwide quality program.

A native of Chicago, Richard attended North Park Academy and received a bachelor's degree in electrical engineering from Northwestern University. He has an MBA from the University of Chicago. He served in the U.S. Air Force for four years.

He is a member of the American Society of Quality Control.

Mr. WALGREN. Thank you very much.

I guess we should suspend, and let us answer this roll call on the Floor. Mr. Brown will be back shortly, and perhaps you can get going with him, Mr. Leach, and we will go as quickly as we can to be here for the balance of your testimony.

[Recess.]

Mr. BROWN [presiding]. Would you gentlemen like to continue so that we can get through here some time today. You had finished, Mr. Buetow, and Mr. Leach is next.

Let's go through your statement, Mr. Leach, and the other Members will be back shortly.

Mr. LEACH. Okay. Well, thank you, Mr. Brown.

As the small business winner of the Malcolm Baldrige National Quality Award, we at Globe Metallurgical feel very strongly that winning the award is the most significant event in the history of our company, which goes back to 1873. It has lifted Globe Metallurgical from a position of total obscurity to a situation that now we enjoy both national and international recognition and acclaim for our quality system.

In the five months since winning the award, which has been approximately 20 weeks, we have made 35 personal appearances outside of our company addressing top executives and quality professionals around the country who are interested in Globe's quality system. Over 2,000 of these executives have heard the message so far, and the gambit has ranged from private companies who are interested in our system to colleges, to major conferences that are full of quality and top business professionals. The sites for the talks have ranged from such exotic places as Moscow in the Soviet Union to many small towns across the United States.

For the rest of 1989, we are already booked for 37 conventions and major conferences with estimated audiences of over 8,000 people, and we are playing in most major U.S. cities as well as such far away and exotic places as Beijing, Shanghai, and Singapore. We have also hosted 20 plant visits at our Beverly and Selma, Alabama, facilities, and we have answered over 200 inquiries for information from people who have expressed an interest in our quality system.

At Globe, we build our quality system around what our customers wanted in their suppliers. We are very fortunate to serve the automotive industry of the United States, and they have been one of the front running industries in promoting quality among their suppliers.

As a supplier to Ford and General Motors, in 1985, we as management of Globe recognized that to remain a long-term supplier to them we would have to install a comprehensive quality system that would make us competitive with anybody in the world that produces the type of products that we produce.

Our system fit the criteria of the Malcolm Baldrige National Quality Award quite well, mainly because we just built it around what our customers were looking for, and, as you probably know, customer service and quality results are a major factor influencing the scores attained in the Baldrige process. So for us, applying was not difficult at all. I know there has been a lot of discussion about

the burden of applying on small business, but if your quality system is comprehensive and alive it is not a difficult process at all.

Highlights of our quality system include a very strong participation and representation of our upper management in the development and implementation of the system. At Globe, since we are a privately held leveraged buy-out type of company, not only is upper management involved but actually the ownership of the company is involved in both formulating the plans for quality improvement and seeing them through implementation.

Our system changed in 1985 from one that was very successfully detection oriented, where we 100 percent inspected everything we produced and everything we received as inbound raw materials to one in which we now are prevention oriented. We try to prevent our mistakes before they happen, and we have installed a very comprehensive quality system that we can check each tiny, little, minute facet of our process, both the production process and the shipping and processing processes and customer service to assure that our customers are always going to get a very consistent product from us every time.

We also very strongly involve our hourly employees in the development of our quality system, and both of our plants are actively staffed by hourly people who are very actively involved in the quality improvement process. Approximately 60 percent of our hourly work force is now involved in quality improvement teams, and they are very successfully coming up with ideas that we are known to implement very quickly at Globe. Being a small company, we can implement things without a lot of bureaucracy or red tape, and our plant managers have quite a bit of latitude in trying to implement the ideas of the hourly employees to keep their involvement alive.

We are dedicated very strongly to customer service, which is, once again, evidenced by the fact that we build our quality system around what our customers' criteria were, and just let me close by saying that winning the award has equated into much more business for our company. The recognition that we have received has brought potential customers to visit us at our plants and to seek information from us, and many of their top executives are wondering why they weren't doing business with us all along when they could have been.

So, really, our business has picked up; the recognition is out there; the award has been a great thing for our company; and we intend to be the best emissaries we can, promoting the award and getting the word out there to the rest of the country, and the world, for that matter.

Thank you.

[The prepared statement of Mr. Leach follows:]

THE EVOLUTION OF QUALITY AT GLOBE METALLURGICAL

By Kenneth E. Leach

Globe Metallurgical Incorporated is a major producer of silicon metal and ferrosilicon products with plants located in Beverly, Ohio and Selma, Alabama. The company has long enjoyed a reputation as a producer of high quality products, and since it can trace its roots back to 1873, Globe is a well-established name in the domestic ferroalloy marketplace. However, it was not until 1985 that the emphasis on quality became a major influence on the way the company produced and marketed its products.

The company credits the motivation and inspiration for this emphasis, which has led to some very impressive improvements in productivity as well as quality, to its customers. Before exploring the current process methodology employed by Globe, a glimpse into its old methods will aid in understanding why the changes have yielded such success.

Pre 1985 - The Days of Detection

Globe originally was a producer of ferroalloy products for the steel industry. From the 1950's well into the 1970's, the producers of these commodity-grade alloys could do no wrong. Everyone was at full capacity, and any increases in costs could easily be passed on to the customer. Thus, Globe, along with the other domestic producers, enjoyed many years of profit and prosperity. Always with an eye toward marketing a quality product, though, Globe's management stocked its chemical laboratories at both plants with state-of-the-art analytical equipment with which every shipment was carefully scrutinized for conformation to the customer's specifications before shipping. During this time, many of the standards for ferroalloys were established at Globe's lab in Beverly.

As the late-1970's approached, imports from many countries, including many "third world" countries, began to penetrate the U.S. market. With rising power rates (ferroalloy production is highly energy intensive) and labor costs, the domestic producers, including Globe, began experiencing an erosion in profitability. The problem intensified into the 1980's and many producers dropped out of the market. Imports began dominating the commodity-grade marketplace, so Globe management began shifting its efforts to higher purity silicon metal products and special foundry alloys, thus becoming a supplier to the domestic foundry industry.

In the foundry market, Globe found that the number of customers with different specifications for similar magnesium ferrosilicon products created some problems coordinating production with shipment requirements. For each major product, such as Inmold or Flotret, Globe produced a generic "mainstream" product and utilizing the laboratory capabilities it possessed from the commodity-grade days, the shipping superintendent would then grade-out product that fit each customer's specifications from the generic production. Once again, each customer was sure to receive a product that was in its specification range, as 100% of the containers in each lot were sampled and analyzed.

October 1985 - The Turning Point

Since serving the foundry industry equates into serving the automobile industry, Globe management recognized in early 1985 that a strong emphasis was evolving for auto suppliers to begin installing more sophisticated quality systems aimed at prevention of problems rather than detection. Management saw that a structured, documented quality system was something that existed only loosely, with no coordination between departments, and became totally committed to building a "world class" quality system. With prizes such as the Ford Q-1 Award and GM's SPEAR certification awaiting the exceptional supplier, Globe management charted its course to becoming a recognized leader in the quality movement.

With a favorable history of few customer complaints, Management strongly believed that Globe's quality was superior. Proving this was going to take some planning. For ideas, Globe turned to the very customers who were expecting the changes to take place. The customers had already spoken, and Globe was listening.

A Customer-Driven System

Rather than employing the services of consulting firms for its direction, a team was assembled to assess the existing quality audits that several of the customers were using, such as the Ford Q-101 audit. The team evolved into Globe's QEC Committee, an acronym for Quality-Efficiency-Cost. The initial QEC Committee was comprised of just three employees: Jim Cline, the Quality Manager; Curt Goins, the Staff Metallurgist, and the author. The group found that implementation of the extensive quality system that was expected was going to be an exhaustive process, requiring hundreds, if not thousands, of manhours.

The QEC Committee identified five key elements that would be essential to the system. These were developed as follows:

- Procedures, which described how employees in different functions interact to perform a function, such as sampling, properly.

- Job Work Instructions, or JWI's, that are much narrower in scope, but similar to Procedures.

- Critical Process Variables, or CPV's, which are the variables that must be controlled within the internal system to assure a controllable final product.

- Product Parameters, or PP's, which are the response to customer specifications, such as SPC charting and process capability assessment.

- Failure Mode Effects Analyses, or FMEA's, which assess everything that can go wrong with an eye toward reducing the risk.

Although winning National Quality Awards is a glamorous achievement, assembling the quality manual was not a very glamorous task. Nearly every employee was interviewed for input, and hundreds of pages of documentation were generated. Simultaneously, the problem of training the entire workforce in at least the fundamentals of SPC was broached. To assist in this effort, Globe employed the services of the American Supplier Institute, who sent a trainer to Beverly to train in-house. Utilizing similar methods, the QEC Committee trained the Selma employees without outside assistance.

Another front that had to be assaulted was developing Globe's suppliers in the tenants of quality and SPC. As a beginning, five major suppliers were invited to attend the ASI training at Beverly. Following up and expanding on that, QEC members visited all major suppliers, and actually trained both their hourly and salaried personnel in SPC. Training materials, blank charts, and even calculators were left with the supplier's personnel. As a result, the suppliers were developing quality systems that mirrored Globe's in many respects, and the charts they provided were exactly on the parameters that the QEC Committee expected.

As implementation evolved at Beverly and Selma, it became clear that a daily method of monitoring the program was needed to maintain proper control. The original QEC Committee evolved into the QEC Steering Committee, and all of the top officers of the company, including Arden Sims, the CEO, were added. Plant QEC Committees, chaired by the Plant Managers, were assembled, and comprised of all of each plant's department heads. These committees meet every day, and to facilitate the goal of monitoring the program, they audit all control charts in their departments prior to each meeting and report any out-of-control conditions on CPV's or PP's, and what was done to bring them back into control by the hourly employee responsible. The QEC Steering Committee meets monthly and discusses items broader in scope, such as the over-all direction of the system.

Listening has its Rewards

By December of 1985, the QEC Committee felt that it was ready to be audited, so Ford was invited to Beverly for a Q-101 audit. The auditor had several suggestions in areas that had been somewhat misinterpreted when building the system to include Q-101 criteria, although he clearly appreciated the effort that had been undertaken. He awarded a score of 139 points, with 140 required to pass. The consolation to the Committee was that it was the highest score the auditor had ever awarded for a first-time audit. When the auditor returned in January 1986, he was so impressed with the implementation of his suggestions that he awarded the highest score that the Ford Casting Division had ever awarded up to that time. A Q-1 Award followed in June of that year.

By mid-1986, numerous customers were engaged in auditing and developing their suppliers. As each audit was conducted, the Globe team listened to what they each emphasized, and modified the quality system to include things that would satisfy each of them. As a result, the system became more and more comprehensive, and all customers benefitted from characteristics that each of them required. Scoring records were set during almost every audit.

As the quality system grew, it soon became clear that the operations themselves were operating at record levels. Savings from improved operations and productivity advances were bringing profitability back, and the outlook appeared very bright. The unexpected occurred in June 1986, when Globe's parent company, Moore McCormack Resources, decided to divest of its metal-related businesses, and placed Globe up for sale. Management was able to assemble a successful LBO, and the quality system, which did not lose its emphasis, continued to flourish.

When General Motors visited Globe with the Targets for Excellence audit, the QEC Committee had once again already added elements from that audit to the Globe system. Once again, however, everything was not exactly designed as the auditor expected on the initial visit at Beverly, and a subsequent visit was slated for the Selma plant. Having "gone to school" at Beverly, the QEC team fine-tuned the Selma program to the extent that Selma, which had never undergone a formal customer audit, set the record for the best score GM's Central Foundry Division had ever given in the quality area. That record has been eclipsed only by the Beverly plant's second audit. Beverly was also bestowed the honor of providing Central Foundry with their first certified product from any supplier-Inmold Alloy.

Since then Intermet, another leader in the quality area, has audited Beverly with record results. Intermet provided the QEC Committee with insights early in the development of the quality system as to what was important.

Following most recently, of course, was the awarding to Globe of the Malcolm Baldrige National Quality Award, with Globe garnering the distinction of being the only winner selected in the small business category (under 500 employees). Globe was selected along with Motorola and the Commercial Nuclear Fuel Division of Westinghouse, the large manufacturing winners, for the 1988 award, which is the inaugural award of the program.

Innovative Employee Involvement

Besides being truly customer-driven, the strength of Globe's quality system lies with its employees. Implementation has never proven a problem at either plant, and early on, the employees embraced the concept that job security and the production of a quality product may be directly related. The employees, through quality circles on the plant and even inter-plant level, are constantly putting forth ideas to improve quality, efficiency or cost. In many cases, one idea will have a favorable impact on all three elements.

Besides inter-plant interaction in quality circles, the employees are given responsibilities unheard of in the old days. Now, no supervisors are needed at Beverly on the back-turns or weekends, as hourly group leaders take care of business. Busloads of hourly employees have visited major customers to tour their facilities and obtain an appreciation for the use of Globe's product in the customer's process. Besides building morale, these activities stimulate motivation to never "surprising" the customer with alloy that will not work for them exactly as they expect every time.

The QEC Commitment

QEC is dedicated to continuous improvement. Management is always looking for new and innovative ideas to improve the process. With customer desires as the backbone of the quality system, QEC members are constantly scouring the professional quality community for new ideas to add, and they can be seen regularly at seminars and symposiums across the country. The continuous improvement plan itself is a formal document that is 20 pages long containing 94 items slated for the next five years.

QEC also is dedicated to providing each customer with a product that is of a "normal" statistical distribution. No longer is a generic product produced that is then graded out according to specifications. Each customer now receives a product designed and tailored exactly to its specification. The quality system

fails if a customer receives a product that does not perform to the customer's expectations, even if it was shipped within its specification.

Through the QEC system, Globe is committed to building a partnership with every customer, where mutual trust will evolve into long-term commitment on both sides. Although the journey has been long and arduous, the rewards have been great, but it is clear that the path itself toward total quality is a never-ending one. Globe stands ready to help anyone, in what way that it can, to proceed on the right path.

Mr. BROWN. Thank you, Mr. Leach.

Mr. D'Amore.

Mr. D'AMORE. Thank you, Mr. Brown, for the opportunity to talk with you today about the quality improvement efforts of the 2,400 people at four locations who comprise the Westinghouse Nuclear Fuel Division.

Westinghouse shares the committee's concern about the quality of American goods and services. We believe that managing for total quality is a powerful tool and that it can greatly enhance the global competitiveness of American industry. Westinghouse Electric Corporation has played a leading role in the commercialization of nuclear power since its inception. Our division manufactures nuclear fuel assemblies that form the heart of the commercial nuclear power plants, and today we supply approximately 40 percent of the United States' light water reactor needs, and that amounts to about 7 percent of this country's electrical power.

In our industry, quality has always been of utmost importance. The core of a Westinghouse-supplied 1,100 megawatt power plant contains 193 nuclear fuel assemblies composed of approximately 51,000 fuel rods with over 18 million uranium dioxide fuel pellets, and those fuel assemblies must operate in an extremely demanding environment at temperatures in excess of 600 degrees Fahrenheit and pressures of more than 2,200 pounds per square inch for as long as five years. Our customers, the Nation's electric utilities, depend upon our products for reliable performance. Reactor down time or safety lapses are inexcusable, and today our fuel products are operating at a reliability record that is approaching 99.9995 percent.

We didn't achieve that quality performance record overnight. We began our formal quality improvement efforts in the early 1980's, and up until that time our approach to quality was largely reactive and focused primarily upon compliance with the regulatory agencies that oversee the nuclear industry.

In the early eighties, however, there were dramatic changes in the marketplace, and it caused us to adopt a very proactive approach to quality improvement. As a result of the slowdown in nuclear power plant construction, our market underwent a fundamental shift from mainly providing new fuel for new plants to solely providing reload fuel for existing plants, and at that time we were seeing a marked increase in foreign competition, particularly from the French, German, Swedish, and Japanese nuclear industries. As a matter of fact, two of the four remaining domestic suppliers of commercial nuclear fuel eventually entered into joint ventures with international vendors.

Our experience was not that much different from other Westinghouse businesses during that same time period. In response to maturing market conditions and increased foreign competition, our corporate management took several bold initiatives. First was the decision to compete as a corporation on the basis of quality, and, secondly, commit a significant capital resources to support the quality improvement efforts of all Westinghouse divisions, including the creation of the Nation's first corporate sponsored productivity and quality center. This multi-million-dollar corporate resource, staffed with 125 quality improvement experts, is dedicated to qual-

ity and productivity improvement through the application of innovative management concepts and advanced technologies, and by 1983 our division had likewise recognized that quality was the only really competitive edge available to us.

We therefore decided to make continuous quality improvement the centerpiece of our long-term business strategy, and to focus the energies of our people on the task before us we adopted a single goal for our business. We said we wanted to become universally recognized as the highest quality supplier of commercial nuclear fuel in the world. A cross section of our employees and top management developed a mission statement that proclaimed our values, and the mission statement directs our actions towards achieving our goal.

While we knew where we wanted to go, I can't say that we had a clearly defined master plan for achieving the initiative in the early eighties. We focused our initial attention on the areas where we expected the greatest return. We worked hard at increasing management and employee awareness of the need for quality improvement. In 1983, we published our first quality plan and began to step up our quality-related training efforts for both managers and employees. Early on, we recognized the value of giving employees a sense of ownership in the quality process. Through participative management techniques such as quality circles and quality teams, we began to empower our employees with the authority and the resources they required to perform at their best.

In the mid-eighties, we began to get a better understanding of the management process required for continuous quality improvement. We analyzed the impact of quality failure costs on our bottom line, and we required all of our managers to include nonfinancial quality measures in their strategic plans and management reports. We also trained our people in advance process management techniques, such as "Just In Time" inventory management, statistical process control, and cycle time reduction.

In a technology intensive business such as ours, the need for leading edge management facilities is a given. At our quality program, we began to view automation and new technologies not just as productivity tools but as quality tools, and we increased our investment in new technologies such as computer-aided design and engineering, robotics, artificial intelligence, and expert systems.

In 1985, we developed a qualitative system for tracking and measuring our quality progress across our entire division. Under this system, which we call pulse points, we monitor eight key measures that assess the health and the vitality of our business. Included in the measurement system are key indicators of customer satisfaction, such as fuel reliability and on-time deliveries, as well as internal quality measures like first time through yields of manufactured components.

We have quality scoreboards posted at all of our locations that show our employees and our customers how we are doing in each of those areas on a month-by-month basis. We also track more than 100 quality measures at the division and departmental levels.

During the past several years, we have worked hard to make our customers our partners in quality and performance. We formed fuel users groups with our customers, and we formed joint quality

teams, and we now have individual customer service plans for each customer. We recently added a quantitative measure for gauging customer satisfaction.

But it wasn't until 1988 that we felt we had the pieces of our total quality culture in place. Today, we fully recognize that to produce excellent products you have to have excellence in every part of your organization. We now manage our business around the concept of total quality.

The Westinghouse model of total quality is built on 4 imperatives and 12 conditions of excellence. The first imperative is management leadership. Management's primary responsibility is to lead the creation of a quality culture through their personal commitment and involvement. Strategic planning, communications, and accountability are the other primary conditions of management excellence.

The second imperative is product and process leadership. To achieve world class quality standards, you must have world class facilities and technologies, world class administrative and information management systems, and a world class supplier network.

The third, and in many ways the most important, imperative is human resource excellence. Employee participation, training, and motivation are the primary ingredients of people excellence.

The fourth and final imperative is customer satisfaction. Total quality begins and ends with the customer's perceptions of value received from the products and services rendered. The key, we found, is to internalize the customer satisfaction process, to get everyone in your organization committed to doing whatever it takes to live up to customer expectations.

Now that is a brief description of the quality culture we have attempted to create within our division. Our business has benefited greatly from this proactive approach to continuous quality improvement. Our fuel reliability record is now second to none. Not a single customer has ever had to curtail their plant operations as a result of a fuel rod failure. Our sales and backlog levels are at record highs, and we have been awarded several major international contracts for new business. Quality failure and related warranty costs are down. We have met or exceeded virtually every other quality measure we set for ourselves and, in some cases, several years ahead of schedule. Managing for total quality works.

For our division, the Malcolm Baldrige National Quality Award gave us an opportunity to evaluate our quality efforts against a national standard of excellence. That, I believe, is something American industry has long needed. The award guidelines provide a master plan and a framework for creating a total quality culture, a plan and a framework which we lacked when we began our quest in the early 1980's. It reminds all of American business that quality is indeed a national priority of utmost significance.

Winning the award has reinforced the conviction of our people in the process of continuous quality improvement. They recognize their obligation to live up to the standards of excellence embodied in the honor. In the 1989 quality plan, our people have pledged to pursue still higher quality improvement goals. We have declared 1989 year one of our new quality quest, and we have rebenchmarked all of our quality measures against tougher standards.

The award has also greatly expedited the exchange of ideas between companies. Since November, we have personally shared our quality experience with more than 115 companies. We recently participated in the first annual Malcolm Baldrige National Quality Award Conference which was attended by 450 American business people working on quality improvement in their companies. Our story has been widely publicized in newspapers, business magazines, and trade journals.

The Westinghouse Corporation recently established an internal quality competition called the George Westinghouse Total Quality Awards. It is modeled after the Baldrige Awards, and our chief executive office, John Marous, has pledged cash awards of $200,000 annually to the divisions with the best overall quality program and the most improved program. The winner of the yearly best competition will represent Westinghouse in future Baldrige competitions.

In closing, allow me to quickly summarize a few of the lessons we have learned about the quality improvement management process which I believe are applicable to any business.

First, quality improvement begins with a management commitment to be actively and visibly involved. Management can't pass off the quality ball. Quality planning must be viewed as a fundamental strategy for running a business.

Second, to produce a quality product you have to have excellence in every part of your organization.

Third, some system for quantitatively measuring your quality improvement progress is absolutely essential.

Fourth, it is the customer who ultimately defines the quality level. To be successful, every employee must understand the needs of their customers and be committed to the highest standards of service.

Next, quality improvement requires a long-term commitment. It can never be viewed as just another campaign of the month. We have learned that quality improvement doesn't happen until all employees embrace the concept as a way of life. It is also a continuous and never ending process. No matter what you achieve, you can always do better, and you have to set new standards and expectations each year. In line with this premise, you mu t be able to be open to innovation and be quick to adopt new man gement techniques and quality improvement processes. We found the concepts of cycle time reduction and statistical process control to be particularly useful.

Finally, quality begins and ends with people. There is no more powerful force in business today than employee pride and commitment. Companies don't win awards, people do. The Malcolm Baldrige National Quality Award has given American business a national symbol of excellence to pursue. The real reward, we have discovered, is in the quest itself. Any company that commits to entering the competition is already on the road to winning in the global marketplace.

Thank you for the opportunity to present to you.

[The prepared statement of Mr. D'Amore follows:]

MALCOLM BALDRIGE NATIONAL QUALITY AWARD PANEL
CONGRESSIONAL HEARING

TESTIMONY OF

Mead D'Amore
General Manager
Commercial Nuclear Fuel Division
Westinghouse Electric Corporation

TO THE

SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE
OF THE SCIENCE, SPACE AND TECHNOLOGY COMMITTEE

U.S. HOUSE OF REPRESENTATIVES

April 18, 1989

Washington, D.C.

I would like to thank Congressman Walgren and the Science, Space and Technology Committee for this opportunity to talk with you today about the quality improvement efforts of the 2400 people at four locations who comprise the Westinghouse Commercial Nuclear Fuel Division.

Westinghouse shares the committee's concern about the quality of American goods and services. We believe that managing for Total Quality is a powerful tool that can greatly enhance the global competitiveness of American industry.

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Today we supply approximately 40% of the U.S. light water reactor needs, which amounts to about 7% of this country's electrical power.

In our industry, quality has always been of utmost importance. The core of a Westinghouse-supplied 1100-megawatt power plant contains 193 nuclear fuel assemblies, composed of approximately 51,000 fuel rods and over 18 million uranium dioxide fuel pellets. These fuel assemblies must operate in an extremely demanding environment--at temperatures in excess of 600 ° F and pressures of more than 2200 pounds per square inch--for as long as five years.

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We did not achieve this quality performance record overnight. We began our formal quality improvement efforts in the early 1980s. Up until that time, our approach to quality was largely <u>re</u>-active--and focused primarily upon compliance with the regulatory agencies that oversee the nuclear industry.

In the early '80s, however, dramatic changes in the marketplace caused us to adopt a pro-active approach to quality improvement. As a result of a slowdown in nuclear power plant construction, our market underwent a fundamental shift--from mainly providing new fuel for new plants, to solely providing reload fuel for existing plants.

At that same time, we were seeing a marked increase in foreign competition--particularly from the French, German, Swedish and Japanese nuclear industries. As a matter of fact, two of the four remaining domestic suppliers of commercial nuclear fuel eventually entered into joint ventures with international vendors.

Our experience was not that much different from what other Westinghouse businesses were experiencing. In response to these maturing market conditions and increased foreign competition, our corporate management took several bold initiatives. First was the decision to compete, as a corporation, on the basis of quality. Secondly, it committed significant capital resources to support the quality improvement efforts of all Westinghouse divisions--including the creation of the nation's first corporate-sponsored Productivity & Quality Center.

This multi-million dollar corporate resource, which is staffed with 125 quality improvement experts, is dedicated to quality and productivity improvement through the application of innovative management concepts and advanced technologies.

By 1983, our division had likewise recognized that quality was the only real competitive edge available to us.

We therefore decided to make continuous quality improvement the centerpiece of our long-term business strategy. To focus the energies of our people on the task before us, we adopted a single goal for our business. We said we wanted to become universally recognized as the highest quality supplier of commercial nuclear fuel in the world. Period.

A cross section of our employees and top management developed a mission statement that proclaimed our values. The mission statement directs our actions toward achieving our goal.

While we knew where we wanted to go, I cannot say that we had a clearly defined master plan for achieving this objective in the early 1980s. We focused our initial attention on the areas where we expected the greatest return.

We worked hard at increasing management and employee awareness of the need for quality improvement. In 1983, we published our first quality plan and began to step up our quality-related training efforts--for both managers and employees.

Early on, we recognized the value of giving employees a sense of ownership in the quality process. Through participative management techniques, such as quality circles and quality teams, we began to empower our employees with the authority and resources they require to perform at their best.

In the mid-80s, we began to gain a better understanding of the management process required for continuous quality improvement. We analyzed the impact of quality failure costs on our bottom line, and we required all of our managers to include non-financial quality measures in their strategic plans and management reports. We also trained our people in advanced process management techniques, such as Just-In-Time inventory management, statistical process control and cycle-time reduction.

In a technology-intensive business such as ours, the need for leading-edge manufacturing facilities is a given. Under our quality program, we began to view automation and new technologies not just as productivity tools, but as quality tools, and increased our investment in new technologies such as computer-aided design and engineering, robotics, artificial intelligence and expert systems.

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Winning the award has reinforced the conviction of our people in the process of continuous quality improvement. They recognize their obligation to live up to the standards of excellence embodied in this honor. In our 1989 Quality Plan, our people have pledged to pursue still higher quality improvement goals. We have declared 1989 Year One of our new quality quest, and have re-benchmarked all of our quality measures against tougher standards.

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Fourth, it is the customer who ultimately defines quality. To be successful, every employee must understand the needs of their customers, and be committed to the highest standards of service.

Next, quality improvement requires a long-term commitment. It can never be viewed as just another campaign-of-the-month. We have learned that quality improvement does not really happen until all employees embrace the concept as a way of life. It is also a continuous, never-ending process. No matter what you achieve, you can always get better, and you have to set new standards and expectations each year.

In line with this premise, you must be open to innovation, and be quick to adopt new management techniques and quality improvement processes. We have found the concepts of cycle-time reduction and statistical process control to be particularly useful.

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Any company that commits to entering the competition is already on the road to winning in the global marketplace.

Thank you.

Mr. WALGREN. Thank you, Mr. D'Amore. We appreciate that very much.

The chair would like to recognize the gentleman from California.

Mr. BROWN. Gentlemen, your testimony, while it sounds prosaic in this setting, actually, I feel is really quite inspirational. It establishes that we actually can do the job of improving quality as the first step toward our achieving the national competitiveness that we used to have.

Let me ask you just a question or two. The mythology for years was that the process of continuing to improve quality would cost money, that it would add to the price of the product, and I say that that was the mythology because it didn't seem to be borne out in Japan. But I would like to ask perhaps each of you to comment as to what your experience has been as to the economic effects of your efforts at quality improvement. Has it raised the cost of the product? Has it had other adverse economic consequences?

Mr. BUETOW. Let me speak for Motorola. I'm not sure that you were here when we made our presentation. But one of the key things is that quality is truly free. We will save this year $250 million on quality-related costs that we would have incurred had we not made the improvements over just the last two years. Every quality investment that we have made has paid itself back within the fiscal year and at returns as high as 10, 20, to one, and the best quality is the lowest cost way to manufacture, it is not the opposite; quality does not cost.

Mr. LEACH. At Globe Metallurgical, we have seen the costs of producing our products plummet since we began implementing our quality system. One of the best examples of this, perhaps, would be the fact that we can now document $10.3 million a year in annualized savings on sales of about $100 million; so it is about 10 percent. This equated into a recognition just last week where it was announced that we won the first Shingo Prize for manufacturing excellence which is administered through Utah State University. So we don't feel that we would be there. We feel that we are definitely the lowest cost producer in our industry, and we think that we are making headway all the time through continuous improvement.

Mr. D'AMORE. As I mentioned during my talk, our program really started actively in 1981, and we are in a business today that has about 100 over capacity world-wide. It is not surprising, because the nuclear business since Three Mile Island has slowed down around the world. But it is a very, very competitive business as a consequence.

In 1988, we had our best financial performance as well as our best product performance ever in the history of the division, and our division is some 22 years old. I think that speaks for itself. But more importantly, I believe, is that we have been able to pass on better values to our customers as well as lower prices as a result of being able to lower the cost through our quality orientation.

Mr. BROWN. Well, that's almost too good to be true, but I'm going to take it at face value.

One or more of you used the term "partnership" in discussing your relationships with your employees, your suppliers, your customers, and I note that—I guess it was you, Mr. D'Amore, men-

tioned your participation in industry meetings in which you shared your experience with others, and amongst those others, I assume, might be your competitors. What is the effect of this kind of partnership? Does it create any down side for you?

Mr. D'AMORE. Well, when I talk about customer partnership, we do in fact do that. We have quality teams between a number of our customers and ourselves, and we focus on areas of particular interest.

Interestingly enough, the first of those were formed back in about 1984 with Florida Power and Light, and Florida Power and Light, among others, helped us along the way with our quality plan. Quality, per se, is like safety. People are not reluctant to talk about it between companies.

We have also had relatively open access to Ford Motor Company. When we wanted to look at teams, a technique to put teams into a new automated line we were building, we visited 20 companies across the United States. All of them were very open with us. We, in turn, are doing the same. I think that most people and most of our employees like that participative management approach; they like to be in partnership with our customers; our customers like it. We have been able to make significant improvements as a consequence both in the design of our product and the cost to our customers.

I think the fact that we are here today sharing quality information is a good indication. I don't think it is an activity that you can't talk about even with your competitors, because it is the implementation of the process that brings you the benefits.

Mr. BROWN. Let me just make one final comment. About 40 years ago, I was employed by a leading utility, and I recall very clearly that we were undergoing a wave of management improvement kinds of activities. We had employee suggestion plans innovated. I remember we had the weekly safety meetings of the employees, and we tried to inspire them with the need for improved safety, and yet I don't feel that that really caught on; it didn't have the overall impact on improving quality or efficiency that it might have had. Has that been your experience, that we have made efforts in the past to attack this problem but they may not have always succeeded? just as we tried to improve the quality of technical education after Sputnik and then it kind of deteriorated after a while.

Mr. D'AMORE. Go ahead, Dick.

Mr. BUETOW. Let me take a crack at that. That is what has happened down through the years. There has been a program of the month, a program of the week, and you get tired of those, and what has actually happened—what we did, we went out and benchmarked. When you do that, you look for a company, not necessarily a competitor, that is using a process similar to yours or building a product, though not a competitor, that has the same steps, and we did that. We looked around the world for the best doing that, and what shocks you is, you find that someone somewhere is doing that a thousand times better than you are.

Once you do that and you define what that metric is to get there, you no longer have a program of the month, you have a cultural change, and you start running, and you run hard, you run scared,

and it works; you make dramatic improvements very rapidly. Most people will set 10 or 15 percent goal improvements per year. We say you have got to compound a 68 percent improvement. Most people have never heard of that before.

Mr. BROWN. Well, I think there were some in Congress, although not too many in this committee, who looked upon this Baldrige Award maybe as being just another gimmick, but it seems clear to me that what you have talked to us about and your own experience indicates that it is changing the culture, not just another gimmick.

Mr. BUETOW. Each one of us up here will probably speak to 10,000 people before this year is out. We have committed to over 60 speaking engagements this year, and it is only April, and we have a parade of Top 100 companies coming through, and we are sharing ideas.

Mr. BROWN. You don't happen to get honoraria for that, do you?

Mr. D'AMORE. We don't have that problem.

Mr. BUETOW. It was outlawed long ago.

Mr. WALGREN. The gentleman from Pennsylvania, Mr. Ritter.

Mr. RITTER. Thank you, Mr. Chairman, and I want to thank the gentlemen for their excellent testimony and thank their companies for being great American companies, showing the rest of the world that we can do it as well as anyone, and better, if we set our mind to it.

We just finished hearings in the full committee on creating new wealth for America, and we were discussing the areas of R&D that were crucial to the creation of this new wealth. How important, in your opinion, is full bore adoption of quality to the creation of new wealth for America?

Mr. D'AMORE. I'll take a crack at that with an example. That's a pretty broad subject you are talking about in creating wealth, but let me get it down to something that I think is practical, because I believe that you can create wealth by creating new quality products or bringing value to products or, in fact, bringing new products into the marketplace.

Just about six/seven years ago, our division, in bringing a new product and developing a new product, took six to nine years, depending on the complexity of the product. We have focused on that from a quality aspect relative to doing things right the first time, and I don't mean just out in the shop, I mean from the time the concept is developed through the engineering design portion, through the testing, and into the marketplace, and by doing that we create value for the customers that we serve.

That six to nine months we can do characteristically today in two years, and most recently because our customer wanted an entire new design—one of our customers—we did it in 18 months from concept to delivery. I think that you can't do that unless you are quality oriented, continuously focused on improving every aspect of your operation, and doing the right things right the first time. If you do that, you create wealth at a minimum cost.

Mr. RITTER. Anybody else want to tackle that?

Mr. BUETOW. Yes. I would like to just say that, you know, the only way you are going to create wealth is through added value, and one of the questions here earlier was, do you tell your competitors about what you are doing? The answer is yes, because we are

in many diverse businesses, and some of our competitors are suppliers, are also our customers, and some are all three, and we compete with a country that likes to sell but doesn't like to buy; we are in the electronic business; and for our survival in the United States, we want both our competitors and our suppliers and our customers to survive, and so we are willing to share that knowledge, and I think that is the only way we can do it.

In the R&D, we set ten-year technology road maps just to look at those kinds of things that, one, we have to invent, create, going forward.

Mr. RITTER. Your R&D is in your quality—

Mr. BUETOW. Absolutely.

Mr. RITTER. This is a really crucial point for this whole committee, because Ralph Gomory, when he testified, talked about the product cycle, at which point the R&D is in that, and if the product cycle runs with quality fuel, so to speak, then you can accelerate it in a way that what comes out the other side is going to be desirable and competitive.

But I think it is really important for this committee to realize that science and technology off in a vacuum, divorced from the process and the product that is competing out there, is one of the reasons why, I think, we have not as rapidly brought to market some products and processes that should have been out there and that our competitors brought out.

Mr. D'AMORE. I think all three of us, all three of our companies, focus our quality on the process, and it doesn't make any difference whether the process is management a product or designing a product or developing a product. When you are focused on the process, there is a lot of improvement you can do.

Mr. BUETOW. You can do it in both manufacturing and nonmanufacturing. We have a major thrust in the nonmanufacturing areas to get things done—

Mr. RITTER. You are saying that you can't really divorce R&D from the whole quality strategy of your company.

Mr. BUETOW. To be successful, you cannot have these things mutually exclusive. They have got to work together; they have got to understand. You have got to develop the factory processes along as you design the products.

Mr. RITTER. Are American schools producing workers with as strong enough math and reading skills to handle--

Mr. BUETOW. No. And we can give you the data on that. Surprisingly, about 50 percent of the people that we interview—and we made a major measurement in our cellular product—even though they hold high school diplomas, cannot do fifth grade mathematics or seventh grade reading.

Mr. RITTER. No less statistics—statistical process control.

Mr. BUETOW. They can't spell the word.

Mr. RITTER. It is interesting. As I understand it, in some of our competitor nations they are teaching the statistics necessary for statistical process control in high school so as to upgrade the overall quality of the worker to come into industry and function with these techniques. We don't do that here.

Mr. BUETOW. We spend $45 million a year, 40 percent of which is teaching people quality-related things and upgrades.

Mr. RITTER. Which gets into another thing, the schools. Are we doing enough in our schools, in our universities, to educate our workers of the future—I am talking about all levels of worker from the janitor to CEO's—on the understanding and the principles of quality?

Mr. BUETOW. No. No, we are not. I don't know if they want to make a comment on that.

Mr. RITTER. You see, this is where this committee has some potential influence, because we have the authorizing budget for the National Science Foundation and science education, and I think this is the first time we have ever talked about the education side of quality. But do you want to comment on that?

Mr. D'AMORE. Well, I'm not as abreast of it as Dick is. My division, which is about 2,400 people, has really kind of been on a managed attrition program for the last three years, so we haven't put a lot of people on, but the people that we have put on have been carefully screened, and, quite frankly, I'm impressed. Someone out there is doing the right job with some people, because the people that I've got, which are not massive in quantity, have been excellent, and I'm impressed with people who come out of school knowing computers; they come out computer wise today.

Mr. RITTER. That's the good news.

Mr. D'AMORE. They are very well educated; they are very bright, at least the ones that I've been exposed to.

Now, I have to confess, since I'm not putting on a whole lot, we are relatively selective.

In our manufacturing facilities, Westinghouse, because of their concern of a lack of skills in the manufacturing arena, a number of years ago started a program that they refer to as the MPDP program. But what they do is, they have got skilled recruiters who recruit into Westinghouse people interested in going into manufacturing, and my division uses about eight or ten of those almost constantly, because our approach is to move them around through very many functions on a very detailed, planned program.

Mr. RITTER. Mr. Chairman, if I might, I'm going to interrupt here. I have a meeting that I must attend at 2 o'clock. I intend to return. I am sorry, Mr. D'Amore. But I do want to commend the three of you, because you represent industries which are faced with strong international competition, and each of you and each of your companies has been able to rise above the international competition and to beat that competition, and I think that is a great example for the rest of America.

I plan to return, Mr. Chairman. Thank you very much, and thank you, gentlemen.

Mr. BROWN [presiding] Mrs. Morella.

Mrs. MORELLA. Congratulations. We are very proud of you. I am also very pleased that NIST, which is located in the district that I am honored to represent, has helped with the design and the execution of the program, and I am very proud of what is being done and the fact that you are recipients.

I am interested in the education facet of it, too. It seems to me that you talk about people being scientific and mathematically illiterate; true; and I know that college courses, let alone the need for the remediation that you are talking about, the developmental

courses, probably have something about quality and quality management included, particularly in several areas.

I think, and I am curious about your response in terms of the workers that you have and what you have seen, that maybe a unit could be developed in high schools that could be included in any number of courses that could tie in that would pertain to quality and quality management. Do you think that that would be the time to do something, and, if you do, do you see any possibilities with the Malcolm Baldrige Award expanding—I know you do 60 engagements a year, speaking engagements—but expanding into reaching boards of education or whatever about this incredible problem? Maybe boards of education with the business community combined. More and more there are linkages, because they are needed. Any comments?

Mr. D'AMORE. The answer is yes, certainly there is much that can be done. As a result of the Malcolm Baldrige Award this year, there is no question that a number of us are becoming more involved now, certainly at the college and university levels. We are working with schools of engineering, we are working with schools in business, and we are working with the local community, the junior colleges. In fact, we are sending a lot of our people back there as well as teaching them in our own area.

We have not done as much in the primary school or secondary school levels, and it is a good area, because if we don't do something there we are going to be in deep, deep trouble, because one of the other things is, the workers that we are getting today, only about one in five meet the minimal skills required to work today.

Mrs. MORELLA. And here we are about to, this fall, reauthorize the Perkins Vocational Education Act, and it seems to me that the plumber needs to know quality, the carpenter needs to know quality, that it goes to people who may not go on to higher education.

Anyone else want to comment on that?

Mr. LEACH. Let me add that the statistics involved in statistical process control techniques are not very difficult to master. They are not your theoretical statistics that we study in college and get into all kinds of different things there that you need a computer to even do. They are basically very simple mathematics of averaging numbers and applying some different formulas that are fairly simple formulas.

I think that if we were teaching those kinds of techniques on the secondary level that people would be coming out of high school into even our basic industries, such as our industry, the ferro-alloy industry, and being able to kind of hit the ground running, so to speak, and be able to do these things that we now have to take the time and money to teach them. So I think that would be a good idea.

Mrs. MORELLA. Mr. D'Amore, I guess you just agree.

Mr. D'AMORE. No; no. As a matter of fact, I agree with Ken entirely. You know, to be a mathematical wizard is very difficult, but, in point of fact, the bulk of our people don't have to be that. As a matter of fact, we have a training program on establishment of quality circles that goes through many of the concepts, like the Pareto principles; you just don't call them that. But you have taken and you teach people Pareto principles, you teach them fish-

bone diagrams, you teach them how to establish the urgency of programs and the value in the orderly sequencing, and you can do it with anybody—well, maybe not anybody, but anybody with a high school education can learn those things and learn them rapidly. They don't have to be a real wizard to do them.

I think that I also have some wizards, but I don't have too many of them. I've got a few of them that really understand artificial intelligence, understand expert systems, understand the wealth of statistical programs that can be applied and how to apply them with computers and how to set them up. But by and large, you know, that is one thing the Japanese really did show, that you can teach a worker how to use accounting techniques, how to use Pareto and Ellis's techniques, how to use prioritization techniques, and teach them very well and very quickly, and they respond to it.

I have an operation that will improve dramatically in our Columbia, South Carolina, plant where we process millions of these uranium oxide pellets a year, and it involved a statistical analysis of what we were doing, putting a board up that the operator that controlled the grinding process just plotted data, and he has got control bands that he operates within, and he has been able to markedly improve the product going through that process—did not require an extensive mathematical background to do that.

We have control charts in our plant in Ogden, Utah, literally on every process. The operator didn't have to be a mathematical wizard. We had somebody else develop the control charts, the chemical engineers and our statisticians, that, in all cases, very quickly, our process dropped into the control bands that we wanted.

So I agree with Ken. I think it is the application of theory that can be simplified and taught to almost anybody.

Mrs. MORELLA. I hope this will be a spin-off of the Malcolm Baldrige Awards. Thank you, gentlemen. Thank you, Mr. Chairman.

Mr. BROWN. Thank you, Mrs. Morella.

I am reminded by this discussion of education that, of course, this is a long-standing concern of the committee, one that we fight over year after year, and what it seems to me might be desirable is to have industry adopting these principles of quality improvement look at the schools as a whole as part of their suppliers; it is from there that you draw your employees, of course; and the higher the quality of the product from the schools, the less you are going to have to spend on the training of those employees when they are employed.

Now the problem is one of disaggregation. You don't know which school is going to provide you with your employees. But if you take the partnership concept and apply it to just the schools that, say, are in the vicinity of your plants, see how you could improve the quality of the output there, and sell that concept and more and more companies did it, it would have a massive effect on improvement of the quality of education, and that is what we are looking for.

Mr. D'AMORE. That is an interesting comment.

Our Columbia, South Carolina, plant has an adopt-a-school program, so it works very closely with the schools.

Mr. BROWN. Yes.

As you know, Mr. Deming, who did so much damage to us by what he did in Japan, is trying to atone for his sins by helping American management improve now. I have read these touching stories about this 80-odd-year-old guy trudging from company to company preaching the gospel to them, and it seems to me that you gentlemen are the Demings of America. You are doing that work, and you really are industrial statesmen in doing it.

I don't assume that you are the only ones doing it, but obviously, since you have been singled out for special recognition, you are in the leadership of those who are, and I commend you for that, and I encourage you to do even more, and I hope we will produce a cadre of such people because it will take that to accomplish what the Japanese have done and what other countries are doing.

I think that is all we have for you. Thank you very much for being here. It is a great pleasure to listen to you.

Mr. BUETOW. Thank you.

Mr. BROWN. Our last panel this afternoon is Dr. Christopher Hart from the Harvard Business School, Mr. David Luther from Corning Glass, Dr. John Manley from the University of Pittsburgh, and Dr. Armand Feigenbaum from General Systems Company, and Mr. John West from the Federal Express Corporation.

I trust all of you gentlemen are statesmen of industry as well and that you will enlighten us as to what your companies are doing, or what your schools are doing.

I have heard that Harvard Business School is really at the root of all of the problems that we have today. Is that true?

Mr. HART. Well, that's true, but I'm changing thing.

Mrs. MORELLA. We've got a little search for identity going on there, I see.

Mr. BROWN. All right. Dr. Hart, you can start out, I guess.

STATEMENTS OF DR. CHRISTOPHER W.L. HART, ASSISTANT PROFESSOR OF BUSINESS ADMINISTRATION, HARVARD BUSINESS SCHOOL, BOSTON, MASSACHUSETTTS; DR. JOHN H. MANLEY, PROGRAM DIRECTOR, UNIVERSITY OF PITTSBURGH, PITTSBURGH, PENNSYLVANIA; DAVID LUTHER, SENIOR VICE PRESIDENT FOR QUALITY, CORNING GLASS WORKS, CORNING, NEW YORK; DR. ARMAND V. FEIGENBAUM, PRESIDENT, GENERAL SYSTEMS COMPANY, PITTSFIELD, MASSACHUSETTS; AND JOHN WEST, MANAGER/ASSISTANT, QUALITY IMPROVEMENT PROGRAM, FEDERAL EXPRESS CORPORATION, MEMPHIS, TENNESSEE

Dr. HART. Thank you.

I'd like to speak about what is going on in American schools of business and engineering regarding quality and the role of the Baldrige Award with respect to what is going on in higher education.

Interestingly, I would have thought that quality control, which is a fairly narrow discipline of error detection and correction and that type of thing, would be a staple item in our engineering curricula. However, after being notified that I was being asked to speak today, I surveyed at least 30 students at the Harvard Business School who have engineering degrees. So they represented some 10 to 12 engineering schools and probably an equal number of

engineering disciplines, and it turns out that only the industrial engineers had a course that specifically dealt with a topic that was even so limited as just quality control techniques. I was flabbergasted.

The picture in business schools is equally as bleak. Today, quality is purely a piece of core required production and operations management courses, and it is touched on to some extent in marketing courses, in human resources, you know, but it is basically quality is a buzz word; quality is not taught in business schools as an organized management system, what we have come to recognize as total quality control.

Some things are changing. At Harvard Business School, for example, there are two elective courses in the production department, one called Operation Strategy that has a three-week module on total quality management; David Garvin, a professor at Harvard Business School, who is a member of the board of overseers for the Malcolm Baldrige Award, teaches that course. I have a course that I teach in service management; there is a 12-class module on quality; and that really kind of begs the question, well, why isn't there a course on quality? We see courses on managerial finance, human resource management, all types of specialties; why not quality?

It has a lot to do with the organization of business school curricula and the slowness of change, particularly when you are talking about a topic that is so multi-disciplinary as quality; it touches on finance. I mean if you look at the Baldrige criteria, it touches on every aspect of an organization. Well, now, which department is going to say, "We are going to offer a course in quality"? Which professor is going to stake his or her career to the discipline of quality when it doesn't particularly have a home in any department? In order to get tenure, you have got to be sponsored by the senior professors, and if the senior professors in your department don't view quality as a subject that belongs in their department, it is tough for junior faculty to get that going. Well, it all takes time.

There are things going on today. I see course material being developed. I see that course material being embraced by students, particularly when it is taught in an interesting fashion. As course material is developed, for example, at the Harvard Business School, it will be transferred to other business schools; and, for example, I heard from one of the panelists today that some interesting things are going on at the University of Tennessee, a one-week executive education program on quality. Gee, we have got to find out what is going on out there.

So what it takes is just a slow process of individual faculty members trying to develop material that pertains to this topic and introducing it into their course, and over a while the people who are doing that tend to form a body; that body starts to publish articles together, and sooner or later somebody says, "Gee, we've got an elective course on quality which I plan on developing and submitting for proposed teaching at the Harvard Business School," and once there is an elective course, suddenly maybe there is a textbook; once there is a textbook, suddenly there is an opportunity for professors at other schools to teach an elective; and so it goes.

In particular, I view the Malcolm Baldrige Award as crucial to this process, the reason being that the topic of quality is so complex that it has lacked structure. The organizational behavior people say, "Well, you know, quality is part of what we do; it's quality circles." The marketing people say, "Well, you know, quality, that's what the customers want; that's our game." Production: "Quality is our game." The Malcolm Baldrige methodology makes it clear that it is everybody's game, and it brings structure to an area in which there has so far been a lot of confusion.

The Deming Prize in Japan, I believe, has brought structure to quality in their society. The Baldrige Award, which right now, I believe, is a fragile baby but a healthy child—looks very good—I believe that with the kind of attention and effort that is going into it today that we can see the Baldrige methodology become the currency or the structure, the definition of quality, because language amongst departments is one of the things that creates walls.

We see the same problems in organizations. They say, "Quality; what is it? Well, that's the factory." "No; quality, you apply that to finance, too." Well, the Baldrige Award, I believe, I hope, properly promoted and assuming that the work that has been done by NIST, which is just tremendous, the methodology that is put together—been put together to assess companies' quality, I believe that is going to break down the walls both in companies with respect to developing and deploying quality systems and the same thing in colleges.

To that extent, I think we have got something that is very, very important here. The methodology that has been developed—I was very skeptical about the Baldrige Award. I didn't believe that a methodology for assessing quality across such a broad spectrum of diverse organizations could be done effectively. The group at NIST has done a magnificent job of tackling that, and it is not perfect, they are certainly willing to own up to it, but they are on the right track and continuing to improve it. Now that is a cornerstone for the integrity of the theory that I am giving, which is that the Baldrige Award can serve as a basis for bringing structure to this whole murky field of quality, because if that methodology were not as strong as it is, the prize would become something like the employee of the month, not really rooted in substance.

So that, to me, is an absolute, crucial basis for the award and, in my view, I would like to add, makes this award superior in what it can do for American industry to the Deming Prize, because the Deming Prize is extremely prescriptive. It is administered by the Japan Union of Scientists and Engineers. If your organization doesn't conform exactly to the prescriptive notions of what they say is good quality practice, you don't do very well in trying to win a Deming Prize.

This award, the methodology, with the input of the people in this room and many others, is flexible enough to ask, first of all, "Gee, what is good quality practice in that business?" so that a Globe Metallurgical or a Federal Express isn't required to do the same mathematical, statistical types of techniques that we might find in Westinghouse Nuclear Fuels Division.

[The prepared statement of Dr. Hart follows:]

TESTIMONY BEFORE THE
CONGRESSIONAL COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY

April 20, 1989

Christopher Hart,
Assistant Professor,
Harvard Business School

What is the present level of "quality awareness" in American schools of business and engineering, and what role does the Baldrige Award have to play in promoting that awareness for the future?

Freestanding courses on quality are fairly common in schools of engineering, but their focus tends to be narrow: on quality control on the shop floor, rather than on total quality management systems, the concept embraced in the National Quality Improvement Act.

The picture is bleaker in business schools, where quality is addressed superficially if it is addressed at all. (See the appendix, "Quality Courses in Higher Education.") Most often it is but one of numerous subjects touched upon in required marketing courses and production courses. (Interestingly, it is only rarely mentioned in statistics courses, even though quality-related examples would seem ideal for illustrating basic statistical concepts; the reason is that statistics textbooks are general written by academic, theoretical statisticians unfamiliar with this area of application.)

Of course, some business schools place more emphasis on quality than others do. At the Harvard Business School, for example, MBA students get a broad (albeit brief) exposure to quality concepts in a required course on production and operations management. Additionally, two of Harvard's elective courses, Operations Strategy and Service Management, include a separate "module" on quality, and--as a foundation concept for these courses--quality is a recurring theme in class discussions. (These two electives happen to be among the most popular in the Harvard program.)

Still, while there are courses on cost accounting and management communication (among other things) in the Harvard MBA curriculum, there is no course specifically on quality. Why not? And why do many other business schools ignore the topic altogether? For an answer one must look at the nature of the quality concept, as well as at the realities of how academic departments operate.

First, quality is a comprehensive concept that overlaps with many traditional business-school subjects and hence business-school departments: for example, marketing, management, production, and

human resources. A thorough course on quality would necessarily draw on these other disciplines, a situation that as a practical matter would raise "turf" issues among existing departments. Who should organize a course on quality? And in what department would a professor of quality management currently find a home (and a tenure track)? Over time, quality might well emerge as a separate discipline with its own department, but the fact that it does not currently enjoy recognition (1) on the same level as other disciplines, and (2) as a discrete discipline, is a major stumbling block (one that the Baldrige Award may help to eliminate).

(It is perhaps worth noting that some of these problems of academic administration have parallels in business organizations. Just as it is not clear which academic department should teach quality courses, many businesses are grappling with which organizational department should oversee quality management. In this respect, quality may be said to be at roughly the same stage as marketing was in the 1960s. Executives then were assaulted with articles on the importance of marketing, but weren't sure where it belonged in their organizations. Over time, as it became better and more widely understood, marketing emerged as a distinct organizational function. Similarly, companies today are hearing more and more about quality, and many are hiring vice presidents of quality and establishing quality departments, but the organization overall generally does not yet know how quality relates to existing functions.)

A second factor affecting the paucity of courses on quality is the manner in which college courses are organized and taught. For most academic subjects, there is an agreed-upon body of knowledge and more or less standardized textbooks. Thus, accounting at Yale is not appreciably different from accounting at Stanford, and a newly hired professor most likely bases his course on the same book, outline, and teaching guides as does a 30-year teaching veteran.

For quality, however, there is as yet no predetermined body of knowledge to be taught and there is a crying need for organized course material. Given the way teaching assignments are often rotated among faculty members, the best way to ensure rapid adoption of high-quality courses on quality is to develop course material that can easily be picked up by professors throughout business education. (The writer is currently developing some such material for use in Harvard's production and operations management course.)

The Baldrige Award methodology can serve as an excellent foundation for the development of well-integrated, substantive material to introduce quality concepts throughout U.S. business schools. Specifically, the quality-rating system designed by Curt Reimann and Ruth Haines, at the National Institute of Science and Technology (NIST)--in my opinion superior even to the systems used in Japan for the Deming Prize--represents a tremendous job of summarizing the cornerstones of quality. In combination

with the excellent program for selecting and training Baldrige Award examiners, developed by NIST with the American Society of Quality Control (ASQC), this system is superbly suited to helping U.S. companies improve quality.

But how much impact, one might ask, can a prize like the Baldrige Award reasonably be expected to have? Is it only a symbol? I believe that Japan's Deming Prize may have been the major driving force behind the current "quality dominance" of Japanese products. The prize is not only prestigious--it is also a practical tool. Japanese companies follow the methodology prescribed by the Japan Union of Scientists and Engineers (JUSE), the group that administers the award, devoting a tremendous amount of time, money, and attention to competing for the prize. The structured approach followed by companies that apply for the award has provided a common "language of quality" and a framework understood throughout Japanese industry--translated, on the college level, into specific course material and structure.

With its excellent design, the Baldrige Award could well have the same galvanizing effect in the U.S. that the Deming Prize has had in Japan. And although it was not created specifically for use in education, its contribution to raising the quality awareness of engineering and business students will be no small part of the effort to reach American goals for quality and competitiveness over the long term.

APPENDIX
QUALITY COURSES IN HIGHER EDUCATION

-- Professor Christopher Hart

An informal telephone survey of quality's role in business-school education was conducted. Although quality was considered to be a theme that was touched on in many areas, it was found that quality is generally not formally addressed except in manufacturing-related courses. In general, business schools include a few classes on quality in their required operations management courses; the topic is then covered in greater depth in elective operations-management courses. A summary of how the topic of quality is covered at nine domestic graduate business institutions is discussed below.

Cornell MBA Program

Cornell's graduate school of management has no course devoted to quality. However, students spend one week in the required introductory operations-management course studying quality; 30% of the operations management elective is devoted to quality. Also some time is spent studying quality in the school's required organizational behavior course.

Harvard MBA Program

In Harvard's required operations-management course, two weeks are devoted to "Quality and Learning." In the operations-management elective, operations strategy, the topic of quality is given another two weeks. A three-week module of the services management elective is also devoted to quality issues.

Massachusetts Institute of Technology (MIT) Sloan MBA Program

Although MIT's business school does not offer a course on quality, their engineering school (which is rather tightly coupled with the MBA program) offers a technical course on quality which a number of Sloan students take. Otherwise, one week of the required six-week operations-management course is spent on quality. In addition, many of the other operations-management courses (i.e., services management and manufacturing policy) have a few classes that deal with quality. Finally, the marketing department teaches quality as it relates to new product development.

New York University MBA Program

W. Edwards Deming teaches two elective courses on quality at NYU: "Management for Quality, Productivity, and Competitive

Position," and "The Planning and Use of Statistical Studies." Another professor teaches an elective, "Statistical Quality Control." Additionally, some quality control is covered in the first year operations management course.

Stanford MBA Program

A "few classes" of Stanford's required operations-management course are devoted to quality. Quality is further discussed in the elective operations-management course. Other electives touch on quality as it pertains to new product development.

Texas A & M MBA Program

According to Len Berry, Lincoln Filene Professor of Retailing and an acknowledged expert in service quality, his research on service quality has generated the most interest (from students and faculty) that he or his colleagues have encountered.

He feels that just as services marketing did not exist as a topic in required marketing courses 10 years ago, today the topic of quality has not yet appeared in required marketing and business curricula. Although eventually courses in quality will be offered, Dr. Berry feels that the evolution of these courses will not be rapid, partially because now is not the time in business education to add courses. The AACSB (American Assembly Collegiate Schools of Business) is emphasizing courses on international business and production. However, due to faculty interest, Berry feels that some institutions will add courses or develop class material. What departments will teach quality? That remains to be seen, as quality is really multi-disciplinary. There is a need for teaching material to be developed and distributed.

Texas A & M does not have a specific course on quality, but the issue of quality is raised in courses on retailing and new product development.

University of California - Los Angeles MBA Program

One class of UCLA's required operations-management course is devoted to quality. Additionally, quality is a theme that is touched on in a variety of classes. Operations-management elective courses devote more time to quality. Otherwise, no other courses devote any formal class time specifically to the issue of quality.

Wharton MBA Program

Of the 14-week required operations-management course taught at Wharton, roughly one and one-half weeks are devoted to studying quality issues. Additionally, last year a visiting professor taught a stand-alone elective course on quality, within the operations management department. However, this course is not being offered this year.

Undergraduate Engineering Schools

Students with undergraduate engineering degrees that now attend Harvard Business School were informally polled. In general, students that were not industrial engineering students received NO quality instruction during their undergraduate degrees. Instead, they learned about quality on the job. Industrial engineering students tended to have some technical instruction on quality, centering around statistical techniques.

However, these students were in school anywhere from five to ten years ago, and most felt that engineering schools today place more emphasis on quality.

Mr. BROWN. Thank you very much, Dr. Hart.

Let's take Dr. Manley next and get both these great institutions of higher education out of the way.

Dr. MANLEY. Okay. Thank you very much.

I want to provide my perspective now, slightly different, from the viewpoint of manufacturing systems engineering education, so from the other side of the halls of ivy here.

Even though quality may be very hard to define in scientific and engineering terms, real pressure placed on engineering activities by means of a continuing top management focus on quality for a manufacturing enterprise will, in my opinion, force quality into the engineering process—and I think that has been evidenced by this previous testimony—and this is the key, that quality is critical to the entire process.

Our manufacturing science program—Master of Science in Manufacturing Systems Engineering, which is a new program at the University of Pittsburgh, emphasizes both a systems and integration approach to real world manufacturing engineering problem solving with an accompanying theme of quality consciousness as a cultural necessity. Now this is the merger between the science, the management, and the culture.

During the development of our curriculum, which took over four years, we discovered that the predominant traditional perspective of manufacturing quality contained in most textbooks on manufacturing engineering is hurting U.S. industry more than helping. Now this is what engineers have not only been taught in the past but are still being taught in most schools, and that is the generally accepted way to ensure quality products from a manufacturing enterprise.

In essence, the theme is that everyone makes mistakes; therefore, a rigorous control system must be initiated to find them. "High quality is achieved when the number of bad parts making their way into the final product is lower than some agreed upon level of quality." This negativistic approach has been translated over the years into a set of elaborate management and engineering procedures that are popularly referred to as quality control. The essence of this approach is contained in my written testimony, and there are 13 points outlining examples of that.

At the University of Pittsburgh, we are now teaching the reasons why many of the traditional quality control methods described above, in the testimony, are truly valuable, so I'm not saying you get rid of that, but also why some are flawed. In addition, we are teaching new concepts and methods that have great promise to improve quality to the point of near zero defect levels. The essence of this approach is to teach the concept that quality is a cultural theme that must be foremost in any organization and do not accept allowable levels of scrap or defective products. Find new ways to continually improve all processes within the enterprise to the point where naturally occurring mistakes can be absorbed by the system so that the output product or service is, in fact, perfect. That is a tall order, but with this as top level direction mediocrity is not tolerated and perfection is sought after by all.

Now this change from a control and test viewpoint to an engineering process quality control perspective is, in my opinion, the

key to better quality. This means that a company works constantly to eliminate the causes of process variability to achieve the goal of producing only products that conform to their individual requirement specifications.

Now I'll give one example. It is now possible to embed powerful microprocessors within virtually any system, collect enormous amounts of data, and process that data in real time. This potential can change batch and discrete manufacturing processes into what can appear to be almost continuous flow processes insofar as technical control is concerned, so the QC or QA engineer no longer has to wait, for example, until a worn out tool produces several bad parts in a row in order for him to detect the quality deviation, as he does with current computing technology. With proper instrumentation and analysis tools installed, he has the capability to monitor tool wear in real time so that he can order a new tool to be installed in plenty of time to prevent the production of even a first bad part.

Thus, the modern use of modern computing technology has made it possible to revolutionize quality in the manufacturing industry. In essence, we are able to jump from a current state of command and control type inspection and go/no go testing to a new world of real time process control in which we can make our products right the first time all of the time, and our engineers of the future are now being educated to have the added capabilities to really make that happen.

So, in summary, I feel that the Subcommittee on Science and Technology should encourage further progress in this vital area by enacting legislation or providing oversight in the following specific areas: first, promoting the education and training of engineers in the modern meanings of quality, such as I have talked about; second, initiate a major program for the development of faculty in engineering to provide the resources to teach our engineers; and I won't dwell on that, but from what I read, we have 1,300 to 1,800 vacant positions in engineering schools in the U.S. today; third, support existing Department of Defense programs such as total quality management, the industrial modernization incentives program, and the manufacturing technology, or the MANTECH Programs; and, fourth, support improvements in the quality of existing university research facilities which help bring these types of things on.

So from a manufacturing systems engineering perspective, an increase in Government investment in engineering facilities and equipment, faculty, and students is really vital to improving the quality of U.S. manufacturing.

So thank you very much for allowing me once again to speak my piece.

[The prepared statement of Dr. Manley follows:]

MANUFACTURING SYSTEMS ENGINEERING EDUCATION QUALITY ISSUES

Testimony
to the
Subcommittee on Science, Research and Technology
Committee on Science, Space and Technology

United States House of Representatives

by

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Introduction

Mr. Chairman: Thank you very much for this opportunity to provide you and your Subcommittee on Science, Research and Technology with my perspective on quality as it relates to manufacturing systems engineering education. The opinions and assertions contained in this testimony have been distilled from a wide variety of written materials, inputs from industry practitioners, university classroom discussions, and my personal experience and research into the subject area.

From an engineering perspective, what we are referring to as "quality" in the manufacturing industry today is highly complex. From my perspective, quality is a term that cannot be defined or described in a single sentence, or even a paragraph. Quality has many meanings to engineers (and others) within the manufacturing industry, all of which are important in their own way.

However, I want to emphasize at the outset that quality ought to be the driver of any development organization, regardless of whether their product is manufactured goods or services. Unfortunately, we all know only too well that quality is not foremost in many organizations. I am confident that others testifying in this hearing will cover the benefits that can accrue to business leaders that adopt quality as their most important objective, as well as the problems that result from its absence.

Thus, even though quality may be hard to define in scientific and engineering terms, real pressure placed on engineering activities by means of a continuing top management focus on quality for a manufacturing enterprise will, in my opinion, force quality into the engineering process. This is the key. Quality is critical to the entire process! If it is inherent in the process, it follows in almost all cases that output products and services will also be of high quality. I say almost, since a perfect product may not be desirable to a potential customer for a variety of reasons. But this is another facet of quality which deals more with human emotion and perception.

To provide you with testimony on the topic of quality within the context of the emerging field of manufacturing systems engineering, I have organized my testimony as follows:

First, I briefly describe the origin and goals of our new Master of Science degree program in Manufacturing Systems Engineering at the University of Pittsburgh. This will provide the context for how we are educating graduate-level engineers on quality.

Second, I outline and briefly discuss the most important quality issues that must be understood by what we refer to as "manufacturing engineers of the future."

Third, I provide some examples to indicate how modern science and technology can help resolve quality issues of importance to engineers.

Finally, I indicate how I perceive various government actions are impacting quality in manufacturing from both a positive and negative manner, and make some recommendations for what should be done in the future.

University of Pittsburgh's Manufacturing Systems Engineering Program

A new Master of Science in Manufacturing Systems Engineering Degree program has been established within the University of Pittsburgh's School of Engineering as the foundation of a systems approach to manufacturing engineering education. The new degree is being offered through an interdisciplinary program in Manufacturing Systems Engineering to qualified practicing engineers and outstanding engineering students.

The MSEP emphasizes both a systems and integration approach to real world manufacturing engineering problem solving, with an accompanying theme of quality-consciousness as a cultural necessity. The intention is to improve enterprise-wide manufacturing effectiveness by:

(a) linking all phases of the manufacturing life cycle from product conceptualization through production to eventual product retirement;

(b) connecting individual tools into integrated manufacturing systems;

(c) developing comprehensive information systems from factory floor data gathering through corporate strategic planning;

(d) recognizing and factoring in the human component of manufacturing from assembly-line worker through top management, especially with regard to quality-consciousness and team organization; and,

(e) applying the latest know-how related to engineering methods, tools, materials, and processes.

In addition to its education and research components, the MSEP will also develop a service component with the intent of being able to provide a "quick

reaction capability" for its industrial partners. Strong faculty ties to industry will be developed through the supervised student internship component, industry-sponsored university research, and where appropriate, industry participation in university teaching. This will significantly increase the pool of up-to-date knowledge and expertise that can be called upon in addressing important problems.

The result is a very effective model of industry-university collaboration, especially through its internships which are expected to foster strong ties with both regional and national manufacturing industries.

Academic Program

The Manufacturing Systems Engineering Program (MSEP) consists of 36-credit hours combining classroom work with an industrial internship. The program is constructed to be completed in one calendar year of full-time study.

The requirements for earning this degree are heavily engineering-oriented and are intended to be consistent in academic content and rigor with the School of Engineering's other master's degree programs. Multiple disciplines are integrated into the MSEP. These include not only the traditional engineering and materials science disciplines, but software engineering, computer engineering, human factors, and engineering management.

In addition to traditional engineering subjects, new elective courses that emphasize international competitiveness are being developed for the MSEP by faculty in the Joseph M. Katz Graduate School of Business. Other course modules are being developed jointly by School of Engineering faculty, industry experts, and researchers from the Center for Hazardous Materials Research (CHMR). Finally, renowned guest lecturers from the Pacific Rim and Western Europe are brought to the MSEP classrooms by the University Center for International Studies, where they provide an international perspective on manufacturing economics, technology, and cultural differences.

Thus, the MSEP course content varies from a rigorous master's level in the form of both cross-listed and specialized MSEP elective courses, to a high-level seminar that provides the student with a broad perspective and understanding of significant, current issues facing the manufacturing industry.

Quality Issues in Manufacturing

During the development of our MSEP curriculum, we discovered that the predominant traditional perspective of manufacturing quality contained in most textbooks on manufacturing engineering is hurting U.S. industry more than helping. This is what engineers have not only been taught in the past, but are still being taught in most schools, that is, the generally accepted way to ensure quality products from a manufacturing enterprise.

In essence, the theme is that everyone makes mistakes. Therefore, a rigorous control system must be instituted to find them. This implies, for example, that thorough testing is required at well defined points in the product life cycle process to find "bad parts" in order to weed them out before they cause a defective end

product. High quality is achieved when the number of bad parts making their way into the final product is lower than some agreed upon level of "quality."

This conventional thinking correctly assumes that no human being is capable of producing a perfect product all of the time. The problem in the engineering community is the fact that this thought process supports management "Theory X," or that people inherently do not like to work. This negativistic approach has been translated over the years into a set of elaborate management and engineering procedures that are popularly referred to as "quality control." The essence of this approach is outlined below:

1. Quality is a subfunction of a so called "command and control" management system. This is a hierarchical, multi-layered, top-down control system. Quantitative goals are set by management for quality, among other things, and the subordinates work to meet those goals.

2. Quality is expected to be bad, since people are expected to make mistakes. Therefore, managers need to find out where the mistakes are being made, and to what degree. As long as the degree of "badness" is within the quantitative limits set for that operation, everything is assumed to be satisfactory.

3. It is also assumed that quality costs must be traded off against productivity costs. The logic is that both cannot be low at the same time, since the effort expended in trying to find all of the bad parts costs time and money. This time and money can be better spent producing more parts, good and bad, so that productivity (in the sense of output per unit input) will go up if time is not "wasted" in fine tuning quality.

4. In this organizational culture, products and services are not expected to be perfect. Therefore, to appease customers, quality inspection, and testing techniques are prominently touted in brochures, campaigns, posters, and so forth. When some useful new method such as "quality circles" is employed on the shop floor, it is often not very effective, since management views this extra expenditure of direct labor hours as counter to meeting productivity goals in a top-down culture. In other words, if it is not planned by the top of the hierarchy, it is viewed as an inefficient waste of time, except for meeting marketing needs to show a good face to the customer.

5. Some examples of engineering techniques generated by this traditional approach include:

   a. Statistical quality control methods.

   b. Inspection procedures.

   c. Quality and production goal trade-off methods.

6. Quality control, or QC, is a defined function that has traditionally been the liaison between manufacturing and design. This function interprets design engineer's specifications for manufacturing and develops a quality plan to be integrated into manufacturing engineering's instructions to operations. In this mode, QC is responsible for recommending to management the level of manufacturing losses that can be tolerated, i.e., the cost of mistakes in producing the product.

7. More recently, quality control has become involved with ensuring levels of final product quality to customers. This role is being called "quality assurance," or QA, to distinguish it from in-house QC. This has also developed into "independent" QA subfunctions within the manufacturing function that is more aligned with marketing than engineering. This has widened the gap between QA and QC by placing quality control within the manufacturing engineering organization to worry about the process, and QA elsewhere to worry about the product.

8. To apply the command and control approach to quality, another function for engineers is one of "quality planning." This involves process planning and/or inspection planning. The engineers involved develop plans and procedures to ensure that shop floor operations produce final products that conform to designs.

9. One benefit of quality planning is that data is gathered, organized, stored and analyzed on the results of testing for quality. In this way, quality planning can report to management on whether defined quality levels are rising or falling. This leads to accounting data which reflect the cost of doing repair work caused by deviations from planned practice. This cost of repair constitutes an important engineering measure of quality.

10. In the same manner that QC and QA engineers define quality levels for products they produce, they also must determine performance acceptance testing requirements on behalf of purchasing for parts and equipment that their company buys from outside vendors. This is a very difficult task that has major implications, such as how far can a company go with respect to stating quality requirements for their vendor's QC and QA processes? This is one of the primary problems faced by the government, especially the Department of Defense and NASA, in determining precise quality requirement specifications for major pieces of equipment or systems that they acquire. The major problem here is in trying to answer the question, who has the responsibility for ensuring compliance?

11. Within the "top down" environment of traditional QC and QA, the worker feels left out, and rightly so. In this case, management may use participatory programs such as "quality circles." There are many variations on this theme. The essence is forming committees or working groups to solicit ideas on how to improve quality of operations and processes. Even though management may adopt some of the ideas that flow from these groups, they generally fail after a year or so since the insincerity built into a "command and control" working environment cannot be overcome to make participation in this way truly effective. It requires a cultural change.

12. In the real world of manufacturing, scientific approaches to solving quality problems are rarely possible. Total data is not generally collected, and mathematical models are incomplete. Thus, we must make judgments based on incomplete observations or small data sets, since under normal conditions verification of data is usually not possible, and decisions must still be made. Therefore, quality control reports generally take the form of deviation or exception reports that indicate whether some aspect of quality is increasing or decreasing. When a problem is perceived to be occurring based upon such deviations, the process control engineer takes action to correct mistakes. Even though this methodology is imperfect, it is necessary.

13. Finally, in the traditional world of QC and QA, quality is believed to be a real cost. According to one recent textbook, all productivity measurements for a manufacturing company are broken into the following three cost categories:

a. Productivity, direct labor

b. Productivity, all other

c. Quality costs. "The quality cost is a mitigating factor. It is used to evaluate the purity of the other two productivity measurements. If the two productivity measurements (direct labor and all other) are within targeted goals but the quality costs are high, quality is being sacrificed to meet the output goals." [Koenig, Daniel T., Manufacturing Engineering, Harper & Row, 1987, p. 314]

Notice that this traditional thinking supports a direct linkage between productivity and quality costs as stated earlier.

New Approaches to Improving Manufacturing Quality

In our new Manufacturing Systems Engineering Program curriculum at the University of Pittsburgh, we are teaching the reasons why many of the traditional quality control methods described above are valuable, but also why some are flawed. In addition, we are teaching new concepts and methods that have great promise to improve quality to the point of near "zero defect" levels.

The essence of this approach is to teach the concept that quality is a cultural theme that must be foremost in any organization. Furthermore, although it is true that people make mistakes, do not accept that as an excuse within a manufacturing operation for producing "allowable" levels of scrap or defective products. Find new ways to continually improve all processes within the enterprise to the point where naturally-occurring mistakes can be absorbed by the system so that the output product or service is in fact perfect. This is a tall order, but with this as top-level direction, mediocrity is not tolerated, and perfection is sought after by all.

Furthermore, we emphasize that the term "quality" is multifaceted and does not have a single clear definition, much like the words "system" and "environment." On the other hand, the term must be clearly defined, however, if we expect engineers to make quality better. The reason is that engineers are trained to measure their success largely through quantitative measurement. Since this educational process takes considerable time and effort, all of the details cannot be explained here. However, to help convey to the Committee the essence of this approach, I have divided "quality" into two parts, one that is understood and can be operated on by engineers, and the other that is more qualitative but still very important.

With respect to engineering, we are concerned with those facets of quality that can be engineered into a product. By way of example, the following product quality attributes can be improved by engineering:

1. Product functionality. A product can perform the functions that are required by the task for which it is intended.

2. Product economy. The product can perform its functions at a minimum cost to manufacture.

3. Product safety. The product itself, and its use cannot harm its user or its operating environment.

4. Product reliability. The product is able to perform its functions when needed, even under adverse environmental conditions, or even if some of its components degrade or fail over time.

5. Product usability. The product is easy to operate by the purchaser or user with a minimum of training.

These examples point out that quality is a multidimensional concept that can actually be defined for specific groups of people and situations, in this case, attributes that are of interest to the product development process. Once the product is in service, the following quality attributes are of importance to the user and product maintainer, often an engineer:

1. Product mean time to failure. The mean length of time a product will operate satisfactorily before it fails. Even though the delivered product quality was perfect and the customer perfectly satisfied, we recognize that everything eventually wears out. An engineer may ask, how long should that be? This represents yet another dimension of quality that depends on a specific situation that may vary from customer to customer.

2. Product evolvability. The product can be improved or enhanced over time. An engineer may ask in this case, how flexible should this product be so that new features can be added in the future? This attribute is common with automobiles and personal computer designs. A new radio in a car, or a board in a PC can be either easy or hard to install.

3. Product maintainability. The product has parts that can be replaced to restore it to satisfactory service after a component failure. Here an engineer is often interested in whether such a product is repairable, or beyond repair. If it can be fixed, how easy is it to access the broken part?

4. Product mean time to repair. The average time to restore a product to service after a component part fails. This quality attribute is critical to machines in a production line, for example, or an ambulance or other emergency vehicle in its service to a municipality.

The factory of the future, using computer integration, can help answer some of the above questions, especially with regard to the cost of delivered quality. It is relatively easy but prohibitively expensive to inspect out substandard parts. And I will assert that it is virtually impossible to inspect quality into a product. This is precisely where the intelligent use of computers and software can <u>build quality into products</u>. I will discuss this further below.

This change from a *control and test* viewpoint, to an engineering *process quality control* perspective is the key to better quality. This means that a company works constantly to eliminate the causes of process variability to achieve the goal of producing only products that conform to their individual requirement specifications. Notice that this concept extends well beyond engineering methods

such as those espoused by Taguchi that focus on reducing physical part variabilities through experimental design techniques.

Engineering process quality control initiatives must be supported by a complementary revolution in management perspectives on quality. One example of this type of supportive management thinking involves "Total Quality Management," that I believe was defined by the Undersecretary of Defense for Acquisition, Dr. Robert Costello. In a speech at the Interservice MTAG/IMIP '88 Conference in Atlanta last November, General Bernard P. Randolph, Commander of Air Force Systems Command, emphasized this concept by stating, "Total Quality Management, or TQM, marks the armed forces quality revolution." His major points for how the defense industry can improve their quality were to:

a. Plan for the long term when it comes to capital improvements.

b. Continuously improve the system of production.

c. Stop depending on inspection for quality.

d. Develop the technical knowledge base.

I recall another Air Force approach to quality improvement called "Zero Defects" from almost two decades ago when I was an Officer in Air Force Systems Command. At that time, it was a command policy to instill in the troops the notion that they should never make mistakes, but since that was impossible, work at making fewer and fewer until the goal of zero mistakes was reached.

From an engineering perspective, the major differences between the old Zero Defect approach, and the TQM approach is the addition of some realism with regard to technology, and the recognition that you cannot depend on inspection to ensure quality.

Another dimension of this issue deals with the culture of the people involved in the manufacturing process. This has been the subject of much debate, with numerous contrasts being made between the Pacific Rim nations and the United States. In this regard, we have been very fortunate at the University of Pittsburgh to have had many distinguished guest lecturers discuss these matters with our Manufacturing Systems Engineering graduate students. One of these speakers, Mr. Howard Miller, now a Senior Vice President of PBS, Inc., and formerly a Westinghouse Executive Vice President who had a very special three-year assignment in Japan. His job was to spend three years investigating why the Japanese seem to be beating us in manufacturing. It is instructive to quote one part of what he said that was rather startling to our industry-experienced students this past fall.

According to Mr. Miller, "In all my travels to Japan, I have yet to uncover any technological miracle that enables the Japanese to successfully compete in the world market. However, I did recognize that they were extremely conscious of customer needs and quality. Hence, if there are any items that have been incorporated into operations at Westinghouse it would be the ideas of: one, total quality, and two, understanding and satisfying your customer. The ideal of total quality transfers to satisfying all "customers" inside and outside your organization. A commitment to total quality must be made by secretaries, professionals, executives, and any other employee that provides a service to

another. Employees of the United States and Westinghouse must first, understand this concept, and second, practice it with great diligence."

Therefore, this statement by Mr. Miller captures yet another facet of what an engineer of the future must understand. That is, although process and product technologies must be continually advanced to compete effectively in a global economy, they are secondary to the accompanying quality culture. Thus, technologies to improve quality are of higher priority to the manufacturing systems engineer of the future, than are the technologies that can create the "better mouse trap."

Technology Impact on Quality in Manufacturing

Most practicing engineers are aware of the technologies that affect progress in their particular field of engineering. However, when one takes a systems approach to manufacturing as we do at Pitt, every engineer in our program is made aware of technologies emerging from related disciplines as well. The purpose is to help them better understand the enormous impact of technology on the manufacturing industry in general, and quality in particular. This educational approach includes topics concerning product and process implications that point out their necessity for the very survival of the industrial base, and in some ways even the nation with respect to defense.

The higher the level of management, the more the need for awareness of these technology impacts. This emphasizes once again of the need for informed engineering decisions so that the vision, direction-setting and objective-setting lead the enterprise to prosperity and not disaster. The manufacturing systems engineer of the future should be fully aware of what these issues are as they go about their daily work.

The relationships of technology to manufacturing competitiveness and quality was studied and reported on the National Research Council in a 1986 report titled, *Toward a New Era in U.S. Manufacturing: The Need for a National Vision*.

According to the National Research Council, "The most important factor in improving responsiveness, flexibility, costs, and 'quality' will be the effectiveness of management practices, organizational design, and decision-making criteria... Furthermore, the effectiveness of the technology in accomplishing corporate goals is likely to depend on having the most appropriate hardware and software in the CIM system..."

They went on to state, "This view of manufacturing technology is very different from the traditional technical view. Advanced manufacturing technologies are not going to solve all the problems of production. Instead, they will give managers many more options... Dynamic, continuous improvements of manufacturing capabilities will become essential to long-term success."

In essence, the NRC report pointed out that a major advantage of U.S. manufacturing has been in basic research and the resulting product and process applications. For this reason, federal support of basic research in both government laboratories and universities will be increasingly important to the health of U.S. manufacturing. Advanced technologies will give defense

contractors the responsiveness, flexibility, and cost effectiveness necessary to meet a broad range of weapons design requirements and production schedules. Furthermore, the new manufacturing processes made possible by new technologies also will result in completely new products.

From a defense perspective, the NRC pointed out that, "policymakers will need to recognize the growing link between advanced manufacturing technology and advanced weapons systems."

But they also correctly stated that "...all the interrelationships and long-term implications of advanced manufacturing technologies are not yet well understood."

In essence, continual improvement in technology is essential for survival in today's manufacturing environment. However, as pointed out above, technology is not the only element necessary to achieve higher quality products and manufacturing processes. What technology can do to help is summarized briefly as follows:

1. Advanced manufacturing technology provides managers with flexibility.

2. Basic research provides a major advantage to U.S. manufacturing in both process and product applications.

3. Advanced manufacturing technologies are essential for the defense industrial base.

4. The overall impact of technology on manufacturing can be detected in competitiveness, e.g., market share and trade balances.

5. Advanced manufacturing technologies applied to new process quality control concepts can provide a major advantage.

Since computing technology is my personal area of expertise, I feel compelled to amplify the last point above with respect to how computers and software can specifically help improve quality in our manufacturing industry. I will not go into any detail in the areas of CAD, CAM, CAE or robotics, since these are well known to everyone here present. What I would like to do is briefly provide you with my perspective of one of the fuzzier areas of computing technology, Computer Integrated Manufacturing, or CIM.

CIM has become a buzzword and in the past few years a fairly large industry has grown up around it. It is not appropriate to go into detail attempting to explain the phenomenon, but rather explain briefly what its potential is with regard to quality in manufacturing. The central advantage of CIM from a technological point of view, lies in the new computing and communications technologies that permit very rapid distribution of function and real-time information exchange. This allows one to connect people, methods, tools, processes, and physical facilities into integrated wholes. This rapidly emerging capability is the key to solving many problems, one of which is our topic of improving quality in the manufacturing world.

Therefore, the following examples illustrate how computing technology in the form of what is loosely known as CIM can be helpful in improving overall quality:

1. One of the most important uses of computers takes advantage of the enormous increase in raw computing power that has occurred within the past ten years. It is now possible to embed powerful microprocessors within virtually any system, collect enormous amounts of data, and process that data in real time. This potential can change batch and discrete manufacturing processes into what can appear to be almost continuous flow processes, insofar as technical control is concerned. For example, the QC or QA engineer no longer has to wait until a worn out tool produces several bad parts in a row in order for him to detect a quality "deviation" as he does with current computing technology. With proper instrumentation and analysis tools installed, he has the capability to monitor tool wear in real time, so that he can order a new tool to be installed in plenty of time to prevent the production of even a first bad part.

2. The downside of adding more computer power to the factory floor has been its added complexity. On the other hand, recent advances in developing "friendly" human interfaces for complex automated systems can effectively buffer the technological core of these systems from the manufacturing worker to alleviate this problem.

3. Advances in distributed computing and digital communications technology have also made it possible for a manufacturing enterprise to extend its environment to include its suppliers, and in some cases, its customers. Techniques such as Electronic Data Interchange (EDI) physically link computers between suppliers and users. This can be used to advantage to implement Just In Time (JIT) methods, but more importantly, to influence quality of vendor-supplied parts. The current isolation of a plant from its greater environmental system no longer has to be accepted as the norm.

Thus, the use of modern computing technology has made it possible to revolutionize quality in the manufacturing industry. In essence, we are able to jump from a current state of command and control type inspection and "go-no-go" testing, to a new world of real time process control, in which we make our products right the first time, all of the time. We can move from QC and QA concepts to a new world of Process Quality Control or PQC. And, our engineers of the future are now being educated to have the added capabilities to really make it happen.

Government Impact on Quality in Manufacturing

We have been pointing out to our MSEP graduate students at Pitt the extreme importance of the impact that government has on manufacturing systems engineering. In essence, they learn that federal, state, and local policies play an important role in setting the economic and political environment for private business. Government policies can stimulate this process, and every tax, spending, and money supply decision has an impact. But, they also learn that it is extremely difficult to identify specific policies that would be indisputably beneficial and politically acceptable across the broad spectrum of U.S. industry. In other words, government solutions cannot be easily "engineered."

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On the other hand, engineers must understand the enormous impact of government on their profession and the manufacturing industry in particular. Isolated issues and proposed legislation that sound great, may be a disaster waiting to happen. There is often an almost unbelievable impact on profit-making industry that can happen due to a few percentage point changes in inflation, interest rates, capital gains tax, corporate tax, and so forth. This is true, for example, since informed capital equipment replacement decisions in a manufacturing plant are based upon the results of mathematical engineering economic analyses, carried out by engineers. Even though everyone in the enterprise agrees that a new machine tool can help improve product quality, a small change in government-impacted economic parameters such as an interest rate can cause a "don't buy" decision.

The higher the level of management, the more the need for awareness of how these governmental decisions impact on engineering quality capabilities. This emphasizes once again the need for informed engineering decisions so that vision, direction-setting and objective-setting lead a manufacturing enterprise to prosperity and not disaster. Therefore, the manufacturing systems engineer of the future should be fully aware of what these issues are as they go about their daily work. Consequently, we are educating our graduate-level manufacturing systems engineers of the future in this dimension of quality.

Since it is not appropriate in this hearing to go into depth on this subject, I have provided instead, an outline which indicates the large number of ways that government impacts manufacturing industry through support and control legislation and administrative activities. Issues involved with the topics contained in the outline below are discussed in our MSEP graduate courses, both within the School of Engineering, and in our Graduate School of Business.

1. Government support to manufacturing industry:

    a. Direct economic assistance:

        - Tax incentives
        - Research and development grants
        - Start-up funding seed grants
        - Economic development and revitalization
        - Subsidies
        - Government loans
        - Takeovers and/or bail-outs

    b. Indirect economic assistance:

        - Anti-dumping legislation
        - Tariffs and other protectionist legislation

    c. Other assistance:

        - Protection of intellectual property rights
        - Policies and programs to encourage exporting
        - R&D from government laboratories
        - Defense industrial base support programs
        - Government information centers

2. Control of manufacturing industry:

a. Safety regulations:

- Building and construction codes
- Hazardous materials safety, especially disposal
- Workplace safety

b. Human resource controls:

- Equal Opportunity Program
- Affirmative Action Program
- Immigration and naturalization legislation
- Minimum wage laws (small business impact)
- Mandated health insurance
- Social Security
- Statutory holidays

c. Economic Controls:

- Tax structure
- Accounting systems and audits
- Fair Trade Act
- Consumer protection laws
- Price controls (e.g., World War II)
- Rationing (e.g., World War II)

c. General Operation of Enterprise:

- Anti-Trust laws
- Security & Exchange Commission controls
- Commercial Code (State differences)

e. Control of Foreign Trade:

- Import/export licensing
- Military Critical Technology control
- COCOM activities
- Approval of joint ventures (e.g, FSX)

f. Government Foreign Aid:

- Support of foreign investment in the U.S.
- State Department support of foreign students

Summary and Recommendations

We have been undergoing a revolution in thinking about quality as it pertains to engineering in the manufacturing industry sector. This has come about due to the relatively recent inroads made by foreign-produced goods and services into American domestic and international markets, as well as increased competition at home.

Leading U.S. corporations, such as those who won the first Malcolm Baldrige National Quality Awards, have shown the way for others to follow. By applying new principles of quality they have achieved outstanding results. Some of their success was due to engineering and technology, the general subject of this testimony. However, we need a national effort to promote quality. This requires the leadership of all the Members of Congress, especially those concerned with the state of our science and engineering community.

Therefore, I feel that the Subcommittee on Science and Technology should encourage further progress in this vital area by enacting legislation, or providing oversight to agencies in the following specific areas:

1. Promote the education and training of engineers in the modern meaning of quality, in a manner similar to what we are attempting to do at the University of Pittsburgh.

2. Initiate a major program for the development of faculty in engineering to provide the resources to teach our engineers. According to some reports I have read, there are approximately 1,300-1,800 vacant engineering faculty positions in U.S. colleges and universities, and some 60,000 mathematics and science teachers in our secondary schools who are not fully qualified. Furthermore, from what I understand from others, these statistics are not improving.

3. Support existing Department of Defense programs such as Total Quality Management, the Industrial Modernization Incentives Program (IMIP), and the Manufacturing Technology (Mantech) program.

4. Support improvements in the quality of existing university research facilities to help us keep up with increasing competition from both the Pacific Rim and Western Europe.

From a manufacturing systems engineering perspective, an increase in government investment in engineering facilities and equipment, faculty, and students is vital to improve quality in U.S. manufacturing. Since government programs contribute importantly to these three elements of a major portion of the nation's technology infrastructure, they should receive a high priority until such time as we regain our formerly undisputed leadership in world competition.

Thank you once again for this opportunity to provide my thoughts on this vital subject.

JOHN H. MANLEY

Dr. Manley is Professor of Industrial Engineering and Director of the Manufacturing Systems Engineering Program at the University of Pittsburgh. He is also the founder and President of Computing Technology Transition, Inc., a consulting and educational services company.

Prior to joining the University of Pittsburgh in September 1987, Dr. Manley held a wide variety of leadership positions in government, industry and academe. Most recently, he was Professor of Information Systems and Corporate Strategy in the Graduate School of Industrial Administration, and Director of the Software Engineering Institute at Carnegie Mellon University.

Prior to Carnegie Mellon, he served as Vice President for Engineering and Technology, Nastec Corporation; Director of Programming Applied Technology, ITT Corporation; and Assistant to the Director of The Johns Hopkins University Applied Physics Laboratory. These activities followed a 20-year career in the United States Air Force.

His other university affiliations have been with The Johns Hopkins University Department of Electrical Engineering and the Graduate School of Business at The George Washington University.

Dr. Manley holds a Ph.D. in Systems Engineering and Operations Research, and an M.S. in Industrial Engineering and Operations Research, both from the University of Pittsburgh. He also holds a Bachelor of Metallurgical Engineering from Cornell University.

He is a member of the IEEE Computer Society, Society of Manufacturing Engineers, Association of Computing Machinery, American Defense Preparedness Association, and The National Institute for Software Quality and Productivity.

His awards include Alpha Pi Mu, the Legion of Merit, and the Bronze Star.

Mr. BROWN. Thank you very much, Dr. Manley.

I have noted that you have considerably summarized your written testimony which has a wealth of additional detail in it, and we appreciate the effort that you have put into that.

Let's go to Mr. Luther next from the Corning Glass Works.

Mr. LUTHER. Thank you very much, Mr. Chairman.

I'm not going to read the testimony I submitted, you can look at that later, but let me give you a couple of examples.

We have a factory that makes catalytic converters for automobiles. We average one mistake every eight weeks per worker. That's a world class organization. We have a second example where a worker in a particular factory, without a high school education, came in and looked at a process and said, "I can improve it," and eventually brought his own machine to work, much to the dismay of our MIT engineers. Here's a guy with native ability who was encouraged to make his contribution because of total quality.

Third and final example: data processing clerks who, using the concept of a customer, said, "I wonder who gets all these reports we turn out," and, going out and asking their customers, eliminated a pile of reports two storeys high in a given year. And those are examples of what is driving Corning's quality process, which happens to be employee involved.

It started in 1983, mainly driven by fierce pressures in the marketplace, but a number of things have happened since we have got under way. Forty percent of our people are on teams. This is 40 percent of our people world-wide. We have 2,200 teams at work around the world. Last year, we had 16,000 suggestions, which is more than the conventional suggestion system, it is a way of getting employee involvement; and, most importantly and in line with the previous conversation, 3.3 percent of our worker time is spent on training. We are targeted for a 5 percent level. That is 100 hours per year, per worker, world-wide, from the most distant janitor, say, in Germany to the chairman of the board; and, for us, training is a driver.

In looking at the way we are making quality happen—and it's the subject of the paper that I gave you—there's really six items that we're very interested in. One of them is leadership, and that's at the unit level and at the company level. We haven't heard a great deal about that today, but we are changing an organization, the way it behaves. It takes leadership, and if you can't get past that particular step, don't bother going to the rest. The second one has to do with the focus on the customer, and we are going after customers in a way we never dreamed possible before.

The third has to do with training everybody. One of the side effects of training is coming out in the attitudes of our employees, especially at the production level. "You used to say we counted, but we never believed you. Now we believe you because you are spending so much money training us, you've got to believe we're worth something." Unanticipated but interesting side effect.

The fourth direction has to do with employee participation. It is the engine to make this thing work, and it is coming from our employees, and it is their participation that is giving Corning, at least, a particular edge.

The fifth one has to do with communication inside and outside the company, and the sixth one is having a quality process and quality tools, and there's a variety of those. That happens to be the way we are going after it. Since we started, our profitability has doubled; we are in markets in Japan; we are a major world player in areas where we don't think we would have been before; and we think it is a very worthwhile effort.

And one thing that you haven't heard much of either is the amount of time it's taken. We've been at it for five years, and we're just beginning to believe that quality is getting into the organization and that the people really believe us.

Let me make one final comment on the Baldrige Award. This is a home run. Your committee has done a terrific job, in my opinion, in sponsoring this, and I was one of the all time great skeptics when Curt Reimann approached me, and the whole concept of linking a Government administration with quality seemed to me a world class oxymoron; I didn't think that was going to work at all.

You've noticed and commented on Curt's performance. But one of the things that I think hasn't been hit and the thing that I think is the greatest benefit of the Baldrige Award, and that is the blueprint that it provides. We talk about winning, and a lot of people are aimed at that, but, really, the award does a couple of things. It puts quality in nondenominational terms; there's no particular theory overlaying, it is very much common sense, and it appeals to the people who are going after it. It's in laymen's terms. You really don't have to be a rocket scientist to figure out what this is all about. It's got recognizable value.

We were talking earlier about the content of this, and, in fact, in today's Washington Post there's an opening paragraph describing a meeting which I was at, which was Easter Sunday, and in deference to being Easter it started at 9 o'clock instead of 8 o'clock. But everybody in that meeting knew exactly what the criteria meant, and why they were there, and where they were going; and, finally, it points to improvement, and one final comment. It comes out of the process, I see, as both a judge and a participant, and as the concentration moves from "We're going to win the award" towards "We're going to improve our company," and you can see that happening in the process, and I've talked to a number of people who competed last year, who didn't win, who were as excited about the idea of having a blueprint and a direction to go in because they went through the Baldrige process than they would have if they hadn't gone through it; and for me, that's where the whole thing is at.

Thank you.

[The prepared statement of Mr. Luther follows:]

Making Quality a Competitive Strategy: The Corning Experience

Statement of

David B. Luther
Senior Vice President, Quality
Corning Glass Works

Before the
U.S. House of Representatives Science, Space and Technology
Subcommittee on
Science, Research and Technology

April 18, 1989

As the decade of the 1980's opened, Corning's fortunes were influenced by three powerful forces.

The first force was offshore competition. A weak dollar and very efficient, market sensitive offshore producers joined forces to create an intense new level of competition based on product quality and superior service. As a result, markets that Corning had typically enjoyed for decades were being threatened and in some cases lost to very aggressive newcomers. Corning's customers made it clear that the new level of competition had arrived. If Corning expected to continue as a key supplier, it would have to meet the new requirements of very high quality and low cost. If that meant replacing Corning with another company, "so be it," said the customers. Corning's competitive position was changing.

A second force was the profitability level. Simply stated, the company was not achieving its profitability goals. Even though many seemingly rational, short term, reasons existed for the shortfall, the company was unable to significantly improve returns for the stockholders over time.

The third major influence was Corning's work force. At all levels people were asking for more involvement in the decisions that impacted their work. On the production floor, the workers wanted to use their heads as well as their hands. In the office, employees could see better ways of doing things and wanted the freedom to make change. It was obvious that the existing ways of managing work and people were losing their effectiveness. Our people's attitudes and expectations were also starting to change, and change dramatically.

Corning, the company going through these stresses, is a Fortune 200 firm located in upstate New York. With a sales level in 1988 of $2.1 billion and with after tax profitability of $210 million, it markets 60,000 products in four market sectors: Specialty Materials,

Laboratory Sciences, Telecommunications, and Consumer Housewares. Corning considers itself technology driven and spends five-to-six percent of sales each year on research, development and engineering. It has 25,000 employees with about 25 percent of them at offshore locations. The company has been very successful with its partnership arrangements and now enjoys 20 equity ventures in 11 countries.

James R. Houghton was elected chairman of Corning in April of 1983. The most significant challenge he faced was the need to deal with the forces described above, i.e. the changing market place, the changing expectations of the people and the requirement to improve profitability. He elected to meet that challenge by implementing a Total Quality strategy. In October, 1983 Houghton announced that he intended to make Corning a leader in delivering error-free products and services, on time, that met customer requirements 100% of the time.

Several steps started the journey. A director of Quality was appointed, a budget of $5 million was allocated, and quality executives were appointed in each of the sectors. The chairman asked that the new director and the quality executives develop a way to implement a quality process that would meet his goal. The Management Committee, the top six officers of the firm, asked for regular reviews on development of Corning's quality approach.

The Corning Quality Management System was developed, a Quality Institute was built, and a faculty for the institute was recruited from respected, experienced mid-level managers of the firm. The first class was offered in January of 1984. It was attended by the Management Committee and other senior executives, on a weekend.

The Corning Quality Management system was patterned after the Crosby approach. It had four principals: Meet the customer's requirements, achieve error-free work, manage

by prevention, and measure by cost of quality. In addition, the system had 10 steps which helped convert the principals to every day work.

More that 26,000 people attended that first phase of quality education. It was taught worldwide in six languages. Diplomas were signed by the chairman and other senior managers. Employees all signed their diplomas as a sign that they embraced Total Quality and would join the company in achieving the policy:

> *"It is the policy of Corning to achieve Total Quality performance in meeting the requirements of internal and external customers. Total Quality performance means understanding who the customer is, what the requirements are and meeting those requirements, without error, on time, every time."*

In the first two years, most of the time was spent on employee quality awareness training followed by implementation of the quality process at the unit levels. Quality Improvement Teams were formed to guide the process at each site and sub-committees were created around those actions requiring employee involvement such as the creation of recognition processes, communication plans, training tracking capabilities, and the very important process of establishing corrective action teams and systems to fix problems.

In addition to the activities called for by the formal quality system, other supporting efforts were established. In 1984, the first Quality Milestone was held. This two-day event was held for representatives from the teams that make the quality process work. Representatives arrived to spend time in small breakout groups analyzing the strengths and weaknesses of what they were doing and sharing solutions and experiences. In another area, an approach was put together to bring suppliers into the quality effort. Known as "Partners on a Journey," it established new partnerships that replaced price-based decisions with quality-based decisions.

One of the most important and far reaching initiatives came from the senior management in the form of the "1991 Goals." These long-range objectives were the result of the very important senior management function of developing a vision for the company and then pointing the organization towards that vision. These three goals served as statements for future directions. The goals are:

- By 1991, increase employee training for meeting job requirements to an average of 5% of time worked.
- By 1991, achieve a 90% reduction in the most critical errors preventing the attainment of total quality in products, processes and services.
- By 1991, the first day quality of new goods and services will meet customer requirements, and will be equal to or better than the quality of competitive products or the quality of the products being replaced.

Substantial progress has been made since that first announcement in 1983. Quality Awareness training is essentially complete across the organization and is now being given to new employees. Quality Skills Training, also mandatory, is being completed. Twenty-two hundred teams worked at problem solving in 1988 and over 16,000 improvement suggestions were submitted. Training has reached an average of 3.3% of time worked or 66 hours per person, worldwide. A very substantial effort is under way in all of the product divisions to "delight the customer." Error reduction, delighting internal customers, benchmarking to measure against the best of class, and managing the quality process is a way of life in most of Corning today.

Over the past six years, Corning has developed and followed six strategies that served as a set of guideposts for charting the quality course and for evaluating progress. The overall strategy statements have essentially remained intact over the years however, the actions that support each strategy changed considerably.

The following is a description of each of the six strategies as they are viewed today.

I. Provide visible, unquestioned leadershp

Providing leadership is clearly the most important of the six strategies. Corning is fortunate to have a CEO who not only supports Total Quality but who is in fact out in front of the organization encouraging the rest of the people to get involved. As time went on however, it became very clear that leadership at lower levels is just as important as leadership at the very top. In fact, it appears that the most important determinant of success at the local level is whether or not there is a leader who is involved, who is taking risks, who is setting an example and who is providing a clear direction to those in his or her organization.

Early on it became obvious that each leader had to visibly take action to support quality. Generally, that action included developing a vision for the organization that was an understandable and believable goal for everyone in that unit. The best leaders followed the vision with personal behavior that clearly showed that they believed in quality. Encouraging others and recognizing employees for their quality results became a key requirement. Finally, allocating resources, assigning responsibilities and assessing progress all became key parts of the leadership task.

II. Focus on customer results

For the first two years or so, Corning's quality effort concentrated on teaching and implementing the Total Quality process. Emphasis was placed on demonstrating the principals and on asking teams to implement each of the 10 actions. However, it became apparent that the process, as a goal in itself, was not sustainable. Corning's employees were not willing to follow a process for the sake of just receiving completion checkmarks. Emphasis had to be put on those results that the people knew were in line with the

challenge of making a profit. Our Total Quality effort had to be aligned with "real world results." Emphasis then moved much more specifically to understanding and meeting the requirements of internal customers. In late 1987, the emphasis moved to delighting external or commercial customers as Tom Peters came to Corning and reminded us of how far we had to go. Today, the driving force in Corning is on delighting the commercial customer. Error reduction, the second of two main objectives, is very much a part of this since a great deal of customer satisfaction is in fact the removal of errors.

The whole notion of continuous improvement in all activities is also built into satisfying internal and external customers, and this provides the energy for much of the significant improvement in the manufacturing sector. A key characteristic is the move to measurement of errors in parts per million, of using improvement over previous performance as the measure of performance and in using statistical techniques to get all of Corning's products to always meet the customers's specifications.

III. Train all employees

Train all employees is the third strategy and is the one that probably has had the largest impact on the organization. The training question has changed from "Will I take training this year?" to "What training will I take this year?" The 1991 Goal of 5% of time worked for training has pushed the organization to learn what training is needed, to find out where the training can be found and finally, to figure out how the training can be delivered. Training in Corning, which is basically a condition of employment, has resulted in a small university size training activity. The training emphasis is on quality much of the time, but the real emphasis today is on skills training that helps job performance.

Quality Awareness training was the first big company-wide effort. This was followed by mandatory Quality Skills training which focused on Communications and Group Dynamics, Problem Solving Skills and Statistical Tools.

IV. Achieve and recognize employee participation

Employee participation in solving problems in the work area is the energy source for Total Quality. It is that component of the overall effort that has added a new element to the workplace and that new element has resulted in efficient and effective solutions to problems that in the past have gone unheeded or, at best, poorly resolved.

With 2,200 teams involving almost 40 percent of all employees, and with 16,000 suggestions in 1988 alone, a very substantial force of experienced, smart and dedicated people have taught Corning management that the person doing the job is generally the expert and if involved properly, that expert will produce a quality product or service.

Recognition is a major part of the Total Quality. Corning moved from large traditional banquets for people celebrating any fifth-year anniversary to unit events where everyone was invited every year. At the unit event, the supervisor is expected to recognize everyone that he or she can, consistent with the principals of quality.

Corning does not use monetary awards for quality. Personal recognition seems to be much more effective and less likely to create the stress that often goes with giving money. Another variation is the increasing use and effectiveness of more informal, peer recognition that can be utilized by everyone in the unit and not just the supervisor.

V. Communicate about quality internally and externally

Communication has been part of quality since the very first day and has proven to be a challenge ever since. Initially, most of the communication was top down and was meant to convince, or at least inform, all of the people that Total Quality was going to be a key value of Corning. Subsequently, internal communication took the form of "listening" as a major effort was undertaken to ask all North American and European employees about their views of the company and the work place.

Corning took its Total Quality effort public by telling our customers about our intentions. Although we all clearly acknowledged that we had a long way to go in achieving quality, the thought was that customers would better understand our new way of operating if they were informed about—and eventually a partner — in our journey.

VI. Provide a quality process and quality tools

Initially, it was essential to provide a single quality process to the organization in order to foster cross-functional and cross-division cooperation and communication. The shared concept of what quality was all about along with the common vocabulary for all employees provided a very significant advantage for moving the process forward. A key part was the idea that the Awareness Training would be the same for all levels, in spite of organizational and functional differences in responsibilities and tasks.

Providing new quality tools and techniques was and is an ongoing activity. Much of what quality claims as its own has been with us for years, even though the names and the reasons were different. As we mature in the quality process however, there is a need to develop new tools. Corning has installed a process for managing cross-function processes, another approach for analyzing and improving the service that accompanies the product and tools that help in communication and problem solving.

Over time, the emphasis on each of the strategies has changed. In the beginning, the key focus was on Awareness Training. Leadership was also in evidence, mostly in statements with emphasis on the development of the Total Quality Process. In years three and four, we shifted emphasis to quality skills training, to customer attention and to employee participation. Today, the key push is the concentration on delighting the commercial customer which includes major error reduction efforts as well as attention to the service that goes with the product. Achieving more widespread employee participation is an

objective as is the move to provide employee training that is directed at improving job skills. This will likely be the profile for the next several years.

Corning has made significant progress with its Total Quality process. Interestingly, many of our competitors have made progress as well and our relative progress is what counts. Nevertheless, the accomplishments have been substantial and without them, the significantly improved profitability and commercial success of the company would not have happened.

Corning has responded to the forces recognized in the early 1980's. The Total Quality process initially undertaken to deal with the changes fostered by customers, by employees and by stockholders has now become the firm's strongest and most far-reaching advantage.

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Mr. BROWN. Thank you very much, Mr. Luther.

Dr. Feigenbaum.

Dr. FEIGENBAUM. Thank you, Mr. Chairman.

I'm president of the General Systems Company, a Massachusetts-based international engineering firm which implements company-wide quality systems in both manufacturing and service organizations in the United States and throughout the world based on the technology of total quality control which we originated and which has become the international standard for quality programs. I welcome this opportunity to offer comments on the Malcolm Baldrige National Quality Award Program.

In my judgment, a strong and effective start has been made in the Baldrige Program both in the integrity of the awards process itself and in the role of the program as a national quality pace setter. The program deserves enthusiastic support as it enters its second year.

In my judgment, the program has the potential to contribute in three powerful ways to enhancing the urgent task of further strengthening the industrial and commercial competitive advantage of this country through its statement of the national will, its guideline that quality is now a fundamental way of managing, and its recognition that quality leadership is central to America's success in today's marketplace.

First, the Baldrige Award is now a visible expression of America's national will to recognize quality leadership in the face of widespread skepticism about our commitment. This is, of course, clearly important within our own borders but is at least equally vital in international terms because of the message it is now beginning to send to the countries and companies that are our customers and competitors.

For example, on the afternoon of the Baldrige Awards last November, the first publication in this city to seek my reaction was Japanese, the Asahi Shimbun, one of Japan's leading daily newspapers, and as I travel offshore, as I frequently do as CEO of General Systems, I am increasingly asked whether foreign businessmen should interpret the Baldrige Program as a resurgence of American quality emphasis, which in my opinion it is, or, instead, is only a superficial new U.S. ceremony, which the strong and rigorous beginning of this program clearly demonstrates that it is not. Providing this positive signal about America's quality to our international trading partners is, in my judgment, an extremely vital growing role of this Baldrige Program.

A second major contribution of the program is that it provides guidelines to American manufacturing and service concerns to implement quality. A competitively effective quality program requires total implementation of strong quality work processes throughout all areas of the company organization. This rigorous guideline of Baldrige is demonstrated in the companies General Systems has worked with throughout the world over a long period of years. Quality has become the essence of the way they manage their business, not a loose collection of slogans, or a fireworks display of executive speech-making, or a few control techniques for factory workers.

In my judgment, this approach is important not only for the companies who apply for the Baldrige Award but equally so for those who do not. Certainly it powerfully reinforces the position of those American managers—and there are a great many of them—who understand that quality is the key to competitive leadership today. These strong American managers are not merely cheerleaders but have the personal know-how to develop their companies' quality play book and be its quarterback on the field.

The Baldrige Award strongly challenges the position of other American managers—and unfortunately there are also many of them—for whom business leadership has meant finance and marketing, where quality is still thought of as a second level technician's job and where detailed executive attention to a subject like quality can raise eyebrows in some boardrooms where the boardroom may feel they have a technician instead of a CEO on their hands.

Clear recognition of the basic differences between these managerial approaches and the fundamentally different quality results they produce is one of the major values that this Baldrige Program can bring, and is beginning to bring, to our national understanding of the kind of management that succeeds in our competition with offshore programs.

The Baldrige Program also provides a window on national quality trends and a way of encouraging development of detailed, valuable quality information for economic policy-makers. This is the program's third contribution.

Unfortunately, as has been widely discussed here, the graduate schools of business have, with some notable exceptions, treated quality as no more than a footnote in their research and continue to do so. There have been few other sources to fill the major gap in quantifying the underlying quality trends in international competition that can not only be of major value to policy-makers in both business and Government but can really command their attention.

For just one example, research undertaken in our company suggests that in 1988 eight out of ten consumer and industrial buyers in many major international markets made quality equal to or more important than price in their purchase decisions. A comparable estimate for 1978 suggests that no more than three to four out of ten thought this way and bought this way. This doubling of buyer emphasis on quality in less than a decade is one of the most significant trends in marketplace history in this country and obviously of crucial significance to policy-makers when brought to their attention.

The economic impact of the change in purchase decisions also has major importance. Companies with only partial or limited quality programs today have what some of our General Systems engineers describe as a hidden factory, sometimes amounting to from 15 percent to 40 percent of total productive capacity. This hidden factory exists only to fix or repair bad work, to undo errors in invoicing or data flow, to rework unsatisfactory parts, or to retrofit rejected materials.

The difference in costs and productivity is staggering between these firms and those adopting and acting upon the principles of total quality implementation as advocated in the Baldrige program.

Recognition of higher quality is the best way to most—boost much higher productivity, and much higher customer satisfaction certainly is the business economic hallmark of some of the world's strongest product and service companies today.

Clarifying our national understanding of these marketplace and economic quality realities—and that is what they are—taken together with a statement of national will and the guidelines that fundamental is now—now a fundamental way of managing make the Baldrige program potentially a significantly new contributor to America's industrial and commercial strength, and I thank you for this opportunity to offer these comments.

[The prepared statement of Dr. Feigenbaum follows:]

TOTAL QUALITY AND THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD PROGRAM

Testimony before the U.S. House of Representatives
Committee on Science, Space and Technology
Subcommittee on Science, Research and Technology
Washington, D.C. - April 18, 1989

by

Dr. Armand V. Feigenbaum
President and Chief Executive Officer
General Systems Company, Inc.
Pittsfield, Massachusetts

Good morning. I am Dr. Armand V. Feigenbaum, president of the General Systems Company, a Massachusetts-based international engineering firm which implements company-wide quality systems in both manufacturing and service organizations in this country and throughout the world, based upon the technology of total quality control which we originated and which has become the international standard for quality programs.

I welcome this opportunity to offer comments on the Malcolm Baldrige National Quality Award program. In my judgment, a strong and effective start has been made in the Baldrige program both in the integrity of the awards process itself and in the role of the program as a national quality pacesetter. The program deserves enthusiastic support as it enters its second year. This program has the potential to contribute in three powerful ways to the urgent task of enhancing the industrial and commercial strength

of the United States: through its statement of national will; its guideline that quality is a fundamental way of managing; and its recognition that quality leadership is central to America's success in today's marketplace.

First, the Baldrige award is now the visible expression of America's national will to recognize quality leadership in the face of widespread skepticism about our commitment. This is, of course, important within our own borders, but is equally vital in international terms because of the message it sends to the countries and companies that are our customers and competitors.

For example, on the afternoon of the Baldrige awards last November, the first publication in this city to seek my reaction was Japanese -- the Asahi Shimbun, one of Japan's leading daily newspapers. And as I travel offshore as CEO of General Systems, I am frequently asked whether foreign businessmen should interpret the Baldrige program as a resurgence of American quality emphasis -- which in my opinion it is -- or instead as only a superficial new U.S. ceremony -- which the strong and rigorous beginning of this program clearly demonstrates it is not. Acting on this positive signal about America's quality to our international trading partners is, in my judgment, a vital role of the Baldrige program.

The second major contribution of the program is it provides guidelines to American manufacturing and service concerns to implement quality.

A competitively effective quality program requires total implementation of strong quality work processes throughout all areas of the company organization. This rigorous guideline is demonstrated by the companies General Systems Company has worked with throughout the world. Quality has become the essence of the way they manage their business, not a loose collection of slogans or a fireworks display of executive speechmaking or a few control techniques for factory workers.

This approach is important not only for the companies who apply for the Baldrige Award but also those who do not. It powerfully reinforces the position of those American managers -- and there are a great many of them -- who understand that quality is the key to competitive leadership today. These strong American managers are not merely cheerleaders but have the personal know-how to develop their company's quality playbook and be its quarterback on the field. The Baldrige Award challenges the position of other American managers and unfortunately there are also many -- for whom business leadership has meant finance and marketing emphasis, where quality is still thought of as a technician's job, and where detailed executive attention to a subject like quality raises eyebrows at boardroom level. Clear recognition of the basic difference between these managerial approaches -- and the very different business quality results they produce -- is one of the major values the Baldrige program brings to our national understanding of the kind of management that succeeds in our competition with offshore companies.

The Baldrige program provides a window on national quality trends and a way of encouraging development of detailed valuable quality information for economic policy makers. This is the program's third contribution. Unfortunately, the graduate schools of business have, with some notable exceptions, treated quality as no more than a footnote in their research and teaching. There have been few other sources to fill the major gap in quantifying the underlying quality trends in international competition that can be of major value to policy makers in both business and government.

Research undertaken by General Systems suggests that in 1988 eight out of ten consumer and industrial buyers in major international markets made quality equal to or more important than price in their purchase decisions. A comparable estimate for 1978 suggests that only three to four customers out of ten thought this way. This doubling of buyer emphasis on quality in a decade is one of the most significant trends in modern marketplace history and is of crucial significance to policy makers.

The economic impact of the change in purchase decisions also has major importance. Companies with only partial quality programs today have what our General Systems engineers have long described as a "hidden plant," sometimes amounting to from 15% to as much as 40% of total productive capacity. This "hidden plant" only exists to fix or replace poor quality work -- to undo errors in invoicing and data flow and customer service;

to rework unsatisfactory parts; or to retrofit rejected products from the field. The difference in costs and productivity is staggering between these firms and those adopting and acting upon the principles of total quality implementation. Recognition that higher quality is the best way to both much higher productivity and much higher customer satisfaction is the business economic hallmark of some of the world's strongest product and service companies.

Clarifying our national understanding of these marketplace and economic quality realities and trends -- so crucial to our competitive success in today's world -- can be an extremely important outcome of the Baldrige effort.

Thank you for the opportunity to offer these comments.

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BIOGRAPHY

DR. ARMAND V. FEIGENBAUM
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CHIEF EXECUTIVE OFFICER

Dr. Armand V. Feigenbaum is president and chief executive officer of General Systems Company, Inc., a Pittsfield, Mass.-based international engineering firm that designs, implements and puts into operation quality-oriented, integrated systems in major companies throughout the world.

Prior to forming General Systems with his brother, Donald S. Feigenbaum, in 1968, he was for ten years worldwide director of manufacturing and quality control at General Electric.

Dr. Feigenbaum is the originator of Total Quality Control (TQC) and was first to define quality costs as the costs of prevention, appraisal, and internal and external failure. His book Total Quality Control (McGraw-Hill, third edition, 1983) has been published in many languages and is the basic text on quality systems and improvement the world over.

Dr. Feigenbaum served as the founding Chairman of the International Academy for Quality, of which he is the current chairman; twice served as the president of the American Society for Quality Control (ASQC); and is a past chairman of the Council for International Progress in Management. In 1988 he was appointed to the Board of Overseers of the Malcolm Baldrige National Quality Award Program.

On Dec. 7, 1988, Dr. Feigenbaum was awarded the Georges Borel prize, France's highest honor for contributions in the field of quality control. In addition he has been the recipient of numerous honors for his contributions to quality, productivity and management, including the ASQC's Edwards Medal and Lancaster Award.

Dr. Feigenbaum is a graduate of the Massachusetts Institute of Technology with the degrees of Master of Science and Ph.D. His biography is contained in "Who's Who in the World" and also "Who's Who in America."

April 1989

Actionline

TOTAL QUALITY:

The Key to Your Competitive Leadership

By: Dr. Armand V. Feigenbaum

Companies are going to have to offer essentially perfect products that are produced at much lower cost in order to have both market share and profitability strength by the early 1990s.

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Total Quality:
The key to your competitive leadership

by Dr. Armand V. Feigenbaum, President, General Systems Co., Inc.

Within a global perspective, it is clear that some of the world's strongest automotive industry companies are now trying to build their growth around a necessary but tough-to-implement business strategy that fits our increasingly competitive world marketplace.

The strategy is that to have both market share and profitability strength by the 1990s, companies must offer essentially perfect products which are nonetheless produced at much lower cost. The strategy recognizes that this requires essentially perfect quality work processes—not only in production, but also throughout marketing, technology, finance and service, and through the cycle across assembly, mechanical parts, electronics, tires and other supply parts.

This quality objective has not, until recently, been seriously accepted as either realistic or necessary by many companies, which were brought up in the 1970s doctrine that the way for a company to succeed was to make products quicker and cheaper, and sell them hard. These companies are now coming to realize that while making products quicker and cheaper remains a competitive necessity today, making them better is the best way to make and sell them cheaper and quicker.

Our experience at General Systems Co., over many years in our basic business of installing total quality systems in companies throughout the world, is that a strong program with several basic benchmarks achieves this result. These benchmarks are:

- that quality is not a department, but is instead a work process that extends throughout all functions of an organization;
- that the program is effective only to the degree that it provides genuine quality improvement and the opportunity to participate for each and every member of the organization;
- that it must be customer-oriented, rather than internally or technically oriented;
- that it brings new quality technology to the organization—not merely the reshuffling of old techniques; and,
- that it is one of the most cost-effective ways to profit growth.

This is *Total* Quality Control. (The Japanese, to whom I introduced this approach many years ago after having earlier introduced it in America, describe it as TQC.) What makes this work for a company is recognition that quality is now a fundamental way of managing the business—not merely a fireworks display of motivational training courses or a one-shot emphasis on quality problem-solving techniques. In other words, quality is now far more than merely trying to cobble up a quick fix to compete with automotive products made in Japan.

The difference between such partial quality control and total quality control is fundamental, in strategic terms. TQC recognizes that basic changes in the American automotive workplace, in the motivation of American workers, and in the complexity of business operations have been primary factors for fueling the quality revolution in the United States. It recognizes that, while the lighted match was Japan, the tinderbox itself was filled by a basic change in the habits of the American automotive buyer.

The lifestyle of today's automotive buyer now depends almost completely upon the reliable, predictable operation of his car or truck—and this customer has little tolerance for the lost time and cost of any failures in these products. This is a fundamental shift from the market of a decade ago.

We have tried to put some numbers on this for our business by reassembling the jigsaw puzzle of the relevant consumer quality data over the past decade. It looks like this.

For the year 1987, eight out of 10 buyers made quality equal to or more important than price in their purchasing decisions. Only three to four customers out of 10 thought this way and bought this way in 1979.

This is the hard arithmetic of why market share depends on quality leadership today. Moreover, when this quality leadership is obtained correctly, it makes cost and quality a sum, not a difference; partners, not adversaries; and can give a product a five-cents-on-the-dollar cost advantage—as much as 10 cents, in some cases. For some companies, this can be the best opportunity for improved return on investment.

By comparison, for many years some managers believed that a choice had to be made between quality and cost, the so-called trade-off decision. This became a self-fulfilling prophecy of the myth that good quality had to cost more than bad quality and make production more difficult. In many companies, this helped to perpetuate what we have long identified as a "hidden plant," sometimes amounting to 15–40 percent of total productive capacity.

This is the capacity that exists because of bad work: reworking unsatisfactory parts; retesting and reinspecting rejected units; or retrofitting products that have been recalled. Quality-leveraged firms owe much of their cost advantage to the strong quality programs that have converted their hidden plants to productive use and acquired additional output at no additional cost.

While awareness of much of this has been growing throughout the American automotive industry over the past several years, and while there have been some outstanding quality improvements, quality results for 1988 nonetheless continue to vary widely in the perception of the U.S. automotive buyer. Accelerating the rate of quality improvement is the most important competitive task facing many management teams today.

The lifestyle of today's automotive buyer now depends almost completely upon the reliable, predictable operation of his car or truck . .

Dr. Armand V. Feigenbaum, President, General Systems Co.

Battling "Nipponeurosis": It starts from within

I spend a good deal of my time offshore in connection with General Systems' business, and I find that the prevailing judgment there—in spite of all the put-off factors from excess capacity on down—is that a strong foreign supplier with an effective quality strategy will continue to succeed in the American market.

There are three widely-held beliefs behind this. One, that some American companies have already given quality their best shot and haven't pulled it off. Two, that those who have won't stick with it when the trade fixes don't get spectacular results. Three, that American trade policy is like a log floating down a river with thousands of ants on it—each one thinks it's steering. In other words, the ambiguity of American trade policies minimizes long-term foreign concern about any genuine barriers to American market penetration.

This aggressive, confident attitude about the impunity with which the U.S. market can be penetrated is being nourished by two factors: a new global competitive strategy and the emergence of a powerful new kind of human resource-based international competitor. I'll get back to that in a moment.

After many years at General Systems, installing total quality systems here and abroad, what's my experience and judgment concerning the American industry's potential for understanding and implementing these quality leadership business strategies in the necessary time frame? It is that there is great capacity for achieving the required results.

Indeed, the quality improvement rate we've been able to achieve recently for some pacesetting American products has been much better than for some comparable foreign products. The persistent belief that quality travels under some exclusive foreign passport is a myth.

But born-again American quality programs will have to do much more than just play catch-up with offshore competitors to get the job done. These programs must institutionalize global quality leadership actions systematically, and in relentless detail throughout marketing, technological and production operations.

Many of us were brought up in our earlier years with the approach that good management was getting ideas out of the heads of the top-level people into the hands of the workers; today we know better. Good management means personal leadership in mobilizing the quality knowledge, skill and positive attitudes of everyone in building and maintaining clear, customer-oriented, quality work processes.

A clear quality management system that people understand and believe in is what makes this work. Our experience with successful quality-leveraged companies has proven that it takes a relentlessly disciplined methodology to establish and maintain this, just as it does for finance, marketing or production.

This brings me back to the subject of human resource-based competition. There has been a tendency to analyze offshore competition in national terms—notably, of course, Japan—and in technical resource terms, such as the effective use in foreign companies of state-of-the-art technology. One of my oldest Japanese friends, with whom I have worked in total quality programs for 30 years, now points out to me that the West shouldn't let what he calls its "Nipponeurosis" blind us to the fact that we face today an even more intensive degree of quality competition from other Japans. A Brazilian girl named Maria Luisa illustrates the point.

The manager of a company in San Paulo, where we have been installing total quality systems, has as one of his lead factory supervisors an outstanding young woman who has excellent multilingual abilities. Because transportation there is uncertain, he occasionally gives her a lift to work. I was with him early one morning, when he drove first along the city's beautiful boulevards, then turned off to some bumpy streets and finally came to a narrow dirt alley. I saw Indians there, cooking their morning meal.

From the alley there soon appeared a neatly dressed young woman carrying a TQC training textbook. Before she got into our car, she turned back to wave goodbye to some poncho-clad Indians. I later learned they were her family, which she was supporting. As we drove off to work, the girl, Maria Luisa, turned to the manager and said, "Sir, this is the day I ask you for your signature on the employee discount form for a refrigerator freezer for me and my family."

Good management means personal leadership in mobilizing the quality knowledge, skill and positive attitudes of everyone in building and maintaining clear, customer-oriented, quality work processes.

Tens of thousands of similarly motivated Maria Luisas are coming out of Latin American alleyways and the bush each year. They want some of the good things in life. They want them in their lifetimes. They are willing and able to work hard to get them. Maria Luisa works in one of the highest-quality manufacturing plants in the world. Other Maria Luisas work there now and more are always coming on.

The grass roots strength of the new international competitors, from Brazil to Korea and from Taiwan to southeast Asia, lies in the strong motivation of people like Maria Luisa and in their instinctive belief that quality is the basic value. They buy accordingly and work accordingly with the acceptance that essentially perfect work processes are the necessary objective.

We are not there yet, in many American automotive sectors. This slowness of American response can be dealt with by nothing less than personal, knowledgeable, in-line management—leadership that eliminates from today's programs what I call the four deadly sins of some approaches to quality.

The four deadly sins

The first sin is that we sometimes encourage hothouse quality programs—pep-talking, dusting off a few traditional quality control techniques, and off-line programs of technical programs that receive very little real operational support. Such programs tend to be based on sloganeering, superficial change and single-sentence improvement formulas, instead of consistent, *in-line* implementation of the specifics of quality achievement throughout the organization.

Hothouse programs inevitably wither and dry up when touched by heavy production demands, economic fluctuations or budgetary pressures. In these companies, there can be a dozen different quality problem-solving programs, none of which is fully effective because they are blocked at somebody's department wall. So additional task forces are formed to create still more quality improvement schemes. Veteran employees are likely to view them as just more quality crusades that will die and be buried without autopsy, like the seven or eight other crusades they have already seen come and go.

Because there's no ingrained commitment to quality, 30 percent of all resolved customer complaints leave a dissatisfied customer. It's too high a cost for producer, merchant and buyer to pay—a cost that continues to mount because of the network of trouble-shooters required to keep the constant stream of buyer corrective actions on some sort of track. I call this approach "quality failure-driven."

The second sin is that we have sometimes approached quality programs as being primarily for factory workers. This completely misses the reality that white-collar and service areas are among the most crucial and overlooked areas of quality importance.

In these companies, quality is still not a mainline activity in development and engineering, where innovation is thought of as the basic drumbeat for technology, and quality work a much less challenging task. Nor is quality a mainline activity in the finance communities of these companies—even though accounting miscodes and billing mistakes can create more ill will in customers than product returns. Nor is it mainline in marketing—where quality is thought of as what you have to sell to the customer even though the engineers and production people may not be doing it right.

The third deadly sin is the failure to recognize that there's no such thing as a permanent quality level. One of the flaws in traditional automotive quality control programs has been that they establish a single, right-quality level and then target all effort to meeting that level, rather than improving it continually. Today, when this so-called "right" quality level has been attained, global-quality leadership demands more and more upgraded quality levels as a way of life throughout the organization—because this is what customers will demand and what the competition will call for.

Let me give an example to show why the more successful a product becomes, the higher the quality levels it must achieve if it is to grow profitably.

A one percent field failure rate for an electronic component used in vehicle models with a production rate of 50,000 units a year places 500 failing units in the hands of customers or the service organization. A very successful 10-fold sales and production increase to 500,000 units, with the same one percent electronic failure rate, places 5,000 failing units in customers' hands. This is equivalent, in the actual number of potentially dissatisfied buyers, to what would have been the highly unacceptable failure rate of 10 percent at the earlier production rate.

Without a strong continuous quality improvement program, the success in achieving this higher volume could be a time bomb. The products that represent a high risk of customer dissatisfaction are not only those with high failure rate percentages, but also those with high exposure to a large total number of dissatisfied customers.

The fourth deadly sin is the assumption that automation is, of and by itself, the ultimate solution to quality improvement. Experience instead shows that without a quality work process foundation, automation can merely generate more bad products quicker than before and office machines can produce more inaccurate documents more speedily. In effect, we can automate waste. There is a fundamental difference between trying to base quality on robots and people-based programs integrated with mechanization.

These deadly sins of partial quality programs are a pernicious holdover, in some companies, from the fundamentally different environment of the 1970s and early 1980s.

Quality in management

Converting an organization from a make-it-cheaper history to a make-it-better future is perhaps the single most critical personal managerial demand of our times. It depends not only upon managerial quality awareness—as has been emphasized almost to the extreme these days—but even more importantly, in my experience, upon management's quality know-how and the development of the same sureness of touch for quality leadership that the manager's earlier career equipped him for in the leadership of production, sales, technology or finance.

General Systems' experience is that the effectiveness of this quality leadership depends upon a foundation of relentless, total quality control program work with three essential steps.

The first is the business decision to make global quality leadership a strategic company goal and back it up with the necessary budget, systems and measures. The starting point

is that each key manager personally addresses the existing quality work processes in his or her organization—to take its physical, if you will, to assess present performance, to determine what has to be done to strengthen effectiveness, and then to lead in systematically accomplishing and maintaining these improvements. Anything less is like trying to massage your toes without first taking off your shoes.

This excellence of quality work process approach is a far different managerial task than the widely-used approach that I earlier described as failure-driven, in which the hope has been that the corrective action (quality projects and task forces) will also somehow bring about the repair and modernization of the company's quality process itself. Experience shows that this does not succeed. People change jobs, new task forces are always having to be formed, and the nails always have to be pounded back into this kind of quality management structure.

Total quality implementation

In General Systems' experience, one of the frontier areas in today's automotive industry requiring this emphasis on excellence-of-quality-work process is upstream product development—and we place great emphasis upon Total Quality Control (TQC) application to new product development and introduction.

The need for much reduced cycle time to job one significantly increases the need for this front-end total quality emphasis. The old series approach to development in which quality of the iron is examined at each stage of a step-by-step process is just too slow and has to be replaced by a parallel approach in which product development and quality development proceed together.

Implementing this has meant establishing integrated quality work processes which:

- Make quality a full and equal partner with innovation from the beginning of product development.
- Emphasize getting high quality product design and process matches upstream—not after manufacturing planning has already frozen the alternatives.
- Make the acceleration of new product introduction a primary measure of the effectiveness of a quality program.

When you do this effectively, not only is quality more likely to be very high, but also product development cycles will be reduced by a third or more because of the reduction of continuous engineering changes for quality reasons. In my experience, at least 20 percent of development costs are created by this quality wheel-spinning. Strong upstream quality programs are demonstrating that they are major contributors to lowering these costs and reducing their unplanned bow-wave impact on higher manufacturing costs.

Hence, the second step in total quality implementation is to put in place the clear systemic structure of quality management and technology which will provide genuine help to individuals on their quality work. This implements and integrates the quality leadership policies as effective, commonly agreed and understood quality disciplines which are consistently applied by each key individual and by each department throughout the organization.

This not only supports the marketing and engineering quality actions, as well as related supplier actions, but also quality in production, particularly in terms of productivity enhancement. The reason is that the "hidden plant" is, in part, the direct result of the traditional industrial engineer-

General Systems President A. V. Feigenbaum (right) and Executive Vice President D.S. Feigenbaum scan an aerial view of IVECO Truck Plant in Turin, Italy.

ing approach still being widely practiced and taught, in which quality is of general interest but productivity is planned and measured primarily in terms of a four-letter word, M-O-R-E, as in more output.

It's all right as far as it goes, but it can include components that have defects when they reach assembly or documents that contain errors or products that have to be reworked because they are unreliable. More means production, but not necessarily productivity.

The systemic quality process adds a second four-letter word, G-O-O-D, to modern manufacturing, engineering, planning and management. This retains the production demand for more, but makes it more good—better. Many office and production operations that were previously measured to be 85 to 90 percent productively efficient are really 60 to 65 percent productively efficient when evaluated by this customer-oriented productivity measurement.

A significant part of the substantial improvements needed to bring productivity back to 90 percent or more are now budgeted from improvements in the quality process and they are being achieved in these quality-leveraged companies. This is a driving force for reducing the "hidden plant." It is a big part of the quality and cost connection.

This brings me to the third step, continuous quality participation and motivation, which makes quality improvement a basic and continuing habit relentlessly pursued to ingrain in the detailed work of the company; the actions that recognize quality is a rapidly upward moving target in today's market.

Too often, what has been called quality involvement and participation, has been merely an off-line exercise in motivation without much visible operational support. It has often been ineffective because participation contributes significantly only when it is an integral part of in-line quality activity and is supported by effective quality actions.

To be effective, the emphasis must always be on in-line involvements and on job-related activities that take place at the employee's work station in the plant or office. Only there can the involvement be real and only from there can the quality improvement be passed on directly from job performance to product reliability to customer satisfaction.

This depends heavily on front-line supervisors and the support they receive—an area that has been too often overlooked in the partial quality programs of the 1970s and early 80s. It is they who must provide the employees with leadership, technical guidance and persistent inculcation of the quality ethic on which the success of the entire program rides. The supervisors, for their part, will need the time and tools to do the job, including relief from excessive paperwork, production, data processing and other chores.

In companies with total quality systems, supervisors and foremen are able to spend much more time in teaching and leading employees on quality. Employee participation becomes institutionalized in the quality effort as a sustained in-line program, and front-line supervision in both plant and office becomes, as it should, a principal center of the company's quality activities.

Worth the investment

So much for these steps in establishment of TQC—strategic quality leadership, company-wide implementation, commitment and measurement. There is a strong business reason to move in this direction. The motivator exists in the excellent operating results that have come from genuine leadership policy.

This begins in terms of the ROI—return on quality investment.

Our experience demonstrates that the return on investment results from strong total quality programs in major firms throughout the world today are excellent. They have consistently exceeded the industry ROI pattern from most other customary investments.

There are three reasons for this outstanding return on investment result.

The first has to do with improvements in quality costs. We have been measuring, in our General Systems data base, the effects of quality costs on the income of firms since we first developed the quality cost measurement approach more than 30 years ago. This includes the full costs of assurance (for example, quality improvement programs and process control), plus the full costs of the failure of this assurance, such as customer returns and rework. These data show that the true costs of quality through many major companies in the industry average from 10 to 15 percent of sales, and much more in some products.

The data also show that the quality costs of companies, which have had an emphasis on long-term systematic total quality, were from a half to two-thirds of this average because they improved the prevention effectiveness of assurance. These companies were able to minimize inspection control and greatly reduce the costs of failure. Such quality-cost reductions have become a principal reason for the cost advantage certain major companies enjoy in today's marketplace, an edge that has blindsided some competitors who are largely unaware of what's been happening in these costs. These cost reductions have also enhanced positive cash flow and profitability.

The second reason for the excellent economic results from total quality programs is productivity improvement. A significant proportion of the productivity increases of key firms—often a third or more—is now being achieved by quality programs.

The third reason is that higher sales in today's market result from achieving lower levels of quality failure and service costs.

There is now clear evidence of the positive correlation between market share and market quality. Sales growth that favors products with high quality and low quality costs is becoming characteristic of today's automotive marketplace.

These results emphasize why the very strong, new relationship between competitive leadership and total quality control has emerged as an enormously powerful new influence on management, engineering and marketing policies of companies—both large and small.

The power, innovation and continuity of strong total quality programs are thus becoming a major competitive strength for business growth. The key is, in my experience, that the company has a systematic foundation, so that quality is itself managed and systems engineered and motivated throughout the organization with the same thoroughness and depth that the product itself is managed, engineered, produced and sold.

Certainly, the favorable effect upon business growth of such total quality policies has several examples in American companies whose strong business results speak for themselves today. Certainly, also, personal quality leadership is one of the principal jobs of managers in companies determined to succeed in today's intensely competitive business environment.

Originator
of
Total Quality Control

General Systems is an international engineering firm that designs, implements and puts into operation integrated systems that improve operations, increase productivity and reduce costs in major corporations throughout the world. Each system is custom-tailored for the customer following a thorough analysis of the company's operations and business requirements.

Professional systems engineers work on-site with customer personnel at all levels to replace failure-driven activities with prevention-driven work processes throughout the organization, including marketing, engineering, production and service.

This work is based on proprietary technology derived from 30 years of application experience and the breakthrough concepts of General Systems' founder and president, Dr. A.V. Feigenbaum, who originated Total Quality Control (TQC) and was first to define quality costs.

Like all General Systems projects, the firm's world-famous Total Quality System provides customers with an exceptional return on investment realized not only in higher quality levels and lower costs but in improved cash flow, greater employee motivation, higher productivity, increased profitability, and world-class quality leadership.

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Mr. BROWN. Thank you very much.

I note that there was a quality flaw in the document that I was reading from when I introduced you, and it substituted an "e" for an "l" at the end of "General," and I thought you were some sort of a genetics company at first.

Dr. FEIGENBAUM. I hesitated to bring it to the chair's attention. Thank you for doing so, Mr. Chairman.

Mr. BROWN. We have got to work on that. These principles of quality control apply in Government, don't they?

Dr. FEIGENBAUM. It made me feel very much at home.

Mr. BROWN. Our last panel member is Mr. John West with the Federal Express Corporation.

Mr. WEST. Thank you very much for the opportunity to be here today.

Mr. BROWN. Pull the mike up a little closer, will you.

Mr. WEST. A little closer? Is that better?

Mr. BROWN. That's better.

Mr. WEST. Okay. Our view, first of all, of the Malcolm Baldrige National Quality Award is very positive, and I think if we can get manufacturing, service, and small business enterprises throughout the Nation interested in this we will do a great benefit not only to the companies themselves but to the whole country.

I think the Baldrige Award can have this major impact because the application connected therewith gives a very detailed outline of what it takes for a business enterprise to have a successful quality improvement process. Specifically, applying for the Baldrige Award promotes total involvement of employees, continuous improvement, better customer service, intra-company teamwork, better customer-supplier alignment, reduction of waste, and zero defects. It emphasizes a practical quality which, if approached correctly, will lead to a better place to work for employees, better products, and improved customer satisfaction, and, last, increased profits.

What we are implying here is that while there may be very few companies that are qualified to win the award today, we think it can be, and is beginning to be, a rallying point for quality improvement across the Nation. As was mentioned here earlier today—and I was one that had this experience—there were over 400 people that were trying to get into the Baldrige meeting here in Washington back on April 6 and 7, and it was overflowing, and it was very hard to get in, and I had to argue my way into the session. So I can tell you, enthusiasm is growing.

You may ask, why hasn't Federal Express applied for the award? Quite frankly, last year at this time, when the award came about, we didn't even have a quality improvement process centrally organized. This year, we are not going to apply, in 1989, because of our recent Flying Tiger Line merger. Even had we applied, I'm not so sure that we would have had the total number of needed points to even get an examination.

But my main point here is that this is not a negative point. The Baldrige Award is a stretch even for a company with our reputation, but it is a stretch in the right direction.

Everything we have achieved during our short history has been done without the quality improvement process, except for the past year. It was when we started consistently getting 98 and 99 percent

service levels that we started realizing that we were missing whatever it took to get to 100 percent, and, as Tom Peters says, the noted author, once you get to that point, it's a thousand little things that you have to work on, no one of which will help make a big gain toward 100 percent; and so enter the total quality improvement process. It's a tool that can address those thousand points of darkness—to coin a phrase—within any business.

The Baldrige Award is an excellent vehicle to help propel toward quality. As has been said before, the real prize is the progress the award promotes just by applying. Even if you don't win a physical award, you are really rewarded internally by the improvement gleaned from instituting the quality improvement process.

Our brief comments on the application itself are that we believe that the seven items on the application are the right areas to emphasize. The only potential negative to a service company could be too heavy of an emphasis on statistical process control. While measurement, information, and analysis are extremely important, we don't believe that most service companies need to get into the elaborate details required for excellence in manufacturing firms. For us, simple charts, graphs, and percentage reports will tell us nearly everything we need to know about trends and trouble spots.

In fact, four years ago when we started the quality improvement process, our first effort was a giant mistake. We sequestered all of our senior management into Holiday Inn University across the border in Mississippi, and for the weekend we taught them statistical process control as their introduction to quality. The quality improvement process immediately died for the next two years, because all our senior management thought they had to be statisticians to be able to implement the quality improvement process.

Now to a slightly different angle in terms of the application guidelines themselves. One—we have a few recommendations here, and one of which has been heavily discussed here recently in this committee hearing. We believe that a similar program should be established for the education field. Now my slant is different than what has been discussed so far. I am saying that there should be a blank award—whatever name we give it—for the whole education system, and what I am emphasizing is quality in education as opposed to education in quality. While education in quality is important, I think the other needs to come first.

Another recommendation is, keep the winning criteria tough, and assure cheating is not possible. We just recently had one of our quality trainers return from Japan, and our Japanese employee stated that the Deming Prize is starting to be tarnished a little bit because some companies want the award so much that they found some ways to cheat.

Also, we would like to recommend that at least it be considered that these features of the Deming Prize be looked at for the Baldrige Award: Hold the re-examination after six months for those businesses which missed winning by 50 or fewer points, and award them if they have corrected their shortcomings. Increase the potential number of winners proportionately to the increase in applications. Create a higher award which those who have won the Baldrige Award for which they can compete; and that was really the last of the recommendations. And these are just really a few

thoughts that occurred to us while we studied the Baldrige and Deming award systems. Overall, we believe the Malcolm Baldrige National Quality Award will do as much, if not more, for the United States than the Deming Prize has done for Japan.

[The prepared statement of Mr. West follows:]

MALCOLM BALDRIGE NATIONAL QUALITY AWARD

FEDERAL EXPRESS' VIEW OF THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD IS POSITIVE.

IF SERVICE INDUSTRIES, MANUFACTURING, AND THE SMALL BUSINESS COMMUNITY CAN BE CONVINCED TO PURSUE THIS AWARD, WE FEEL IT OFFERS THE FOLLOWING POTENTIAL ADVANTAGES TO THE UNITED STATES AND THE BUSINESSES THEREIN:

1. TO PUT THE USA BACK IN THE GLOBAL LEADERSHIP POSITION FOR THE PRODUCTION OF QUALITY GOODS AND RENDERING OF SERVICES;

2. TO IMPROVE OUR NATION'S ECONOMY AND TRADE BALANCE ONCE THE QUALITY ADVANCEMENTS ENCOURAGED BY THE AWARD, ARE STARTED BY BUSINESSES ACROSS THE COUNTRY.

FROM OUR VIEWPOINT, THE BALDRIGE AWARD CAN HAVE THIS MAJOR IMPACT BECAUSE THE APPLICATION CONNECTED THEREWITH GIVES A VERY DETAILED OUTLINE OF WHAT IT TAKES FOR A BUSINESS ENTERPRISE TO HAVE A SUCCESSFUL QUALITY IMPROVEMENT PROCESS. IT REQUIRES A RICH HISTORY OF QUALITY ACTIVITIES FOR THOSE APPLYING NOW, AND EXTENSIVE FUTURE QUALITY ACTION FOR THOSE NOT CURRENTLY MEETING THE AWARD'S CRITERIA.

SPECIFICALLY, APPLYING FOR THE BALDRIGE AWARD PROMOTES TOTAL INVOLVEMENT OF EMPLOYEES, CONTINUOUS IMPROVEMENT, BETTER CUSTOMER SERVICE, INTRA-COMPANY TEAMWORK, BETTER CUSTOMER SUPPLIER ALIGNMENT, REDUCTION OF WASTE, AND ZERO DEFECTS. IT EMPHASIZES A PRACTICAL QUALITY, WHICH IF APPROACHED CORRECTLY, WILL LEAD TO A BETTER PLACE TO WORK FOR EMPLOYEES, BETTER PRODUCTS , IMPROVED CUSTOMER SATISFACTION AND INCREASED PROFITS.

WHAT WE'RE IMPLYING HERE IS, THAT WHILE THERE MAY BE VERY FEW COMPANIES THAT ARE QUALIFIED TO WIN THE AWARD TODAY, WE THINK IT CAN BE (AND IS BEGINNING TO BE) A RALLYING POINT FOR QUALITY IMPROVEMENT ACROSS THE NATION. JUST THE FACT THAT THERE WERE MORE REQUESTS THAN THE 400 PLUS SLOTS FOR THE APRIL 6,7 BALDRIGE AWARD SEMINAR HELD HERE IN WASHINGTON TWO WEEKS AGO, SHOWS HOW MUCH THE INTEREST HAS GROWN SINCE LAST YEAR WHEN ONLY 66 COMPANIES APPLIED FOR THE AWARD.

YOU MAY ASK, WHY HASN'T FEDERAL EXPRESS APPLIED FOR THE AWARD?

QUITE FRANKLY, THIS TIME LAST YEAR WE HAD NO CENTRAL QUALITY IMPROVEMENT PROCESS FOCUS AND OUR APPLICATION PROBABLY WOULDN'T HAVE RESULTED IN ENOUGH POINTS TO EARN A VISIT BY A TEAM OF EXAMINERS. THIS

YEAR WE STARTED TO APPLY BUT HAD TO POSTPONE OUR EFFORTS DUE TO OUR FLYING TIGER LINE ~~ACQUISITION~~ MERGER. EVEN HAD WE APPLIED, WE MAY NOT HAVE BEEN ABLE TO EARN THE NEEDED POINTS.

BUT THIS IS NOT A NEGATIVE POINT. THE BALDRIGE AWARD IS A STRETCH EVEN FOR A COMPANY WITH OUR REPUTATION. BUT IT'S A STRETCH IN THE RIGHT DIRECTION.

EVERYTHING WE'VE ACHIEVED DURING OUR SHORT HISTORY HAS BEEN DONE WITHOUT THE QUALITY IMPROVEMENT PROCESS, EXCEPT FOR THE PAST YEAR.

IT WAS WHEN WE STARTED CONSISTENTLY GETTING 98 AND 99% SERVICE LEVELS THAT WE REALIZED THE NEED FOR A BIG PUSH TOWARD 100%. AS TOM PETERS, THE NOTED AUTHOR SAYS, THERE ARE 1,000 LITTLE THINGS STANDING IN THE WAY OF 100%, NO ONE OF WHICH, IF SOLVED, HELPS MAKE A BIG GAIN.

ENTER THE QUALITY IMPROVEMENT PROCESS. IT'S A TOOL THAT CAN ADDRESS THOSE "THOUSAND POINTS" OF DARKNESS WITHIN ANY BUSINESS. THE BALDRIGE AWARD IS AN EXCELLENT VEHICLE TO HELP PROPEL TOWARD QUALITY, ESPECIALLY FOR THE HUNDREDS OF BUSINESSES LIKE US, WHO ARE EITHER JUST BEGINNING OR HAVE NOT STARTED A FORMAL QUALITY PROCESS.

THE REAL PRIZE IS THE PROGRESS THE AWARD PROMOTES JUST BY APPLYING. EVEN IF YOU DON'T WIN A PHYSICAL AWARD, YOU'RE REALLY REWARDED INTERNALLY BY THE IMPROVEMENT GLEANED FROM INSTITUTING THE QUALITY IMPROVEMENT PROCESS.

OUR BRIEF COMMENTS ON THE APPLICATION ITSELF ARE THAT WE BELIEVE THAT THE SEVEN ITEMS ON THE APPLICATION ARE THE RIGHT AREAS TO EMPHASIZE. THE ONLY POTENTIAL NEGATIVE TO A SERVICE COMPANY COULD BE TOO HEAVY OF AN EMPHASIS ON STATISTICAL PROCESS CONTROL.

WHILE MEASUREMENT, INFORMATION AND ANALYSIS ARE EXTREMELY IMPORTANT, WE DON'T BELIEVE THAT MOST SERVICE COMPANIES NEED TO GET INTO THE ELABORATE DETAILS REQUIRED FOR EXCELLENCE IN MANUFACTURING FIRMS.

FOR US, SIMPLE CHARTS, GRAPHS AND PERCENTAGE REPORTS WILL TELL US NEARLY EVERYTHING WE NEED TO KNOW ABOUT TRENDS AND TROUBLE SPOTS.

IN FACT, WE STARTED OVER FOUR YEARS AGO WITH A HEAVY EMPHASIS TO OUR EXECUTIVES ON STATISTICAL PROCESS CONTROL (SPC). IT TURNED OFF MANY OF THEM TO THE EXTENT THAT OUR QUALITY IMPROVEMENT PROCESS LAY PRETTY MUCH DORMANT FOR A YEAR OR TWO UNTIL IT WAS LEARNED THAT SPC WAS NOT AT ALL THE BACKBONE OF A SUCCESSFUL QUALITY PROCESS.

AFTER A REVIEW OF THE 1989 APPLICATION GUIDELINES, WE HAVE A FEW RECOMMENDATIONS:

1. ESTABLISH A SIMILAR PROGRAM FOR OUR NATION'S PRIMARY EDUCATION SYSTEM. WE'VE READ FOR YEARS NOW ABOUT THE INFERIOR QUALITY OF MANY OF OUR PUBLIC SCHOOL SYSTEMS. THE QUALITY IMPROVEMENT PROCESS IS NOT JUST FOR BUSINESSES, BUT CAN BE USED IN VARIED WAYS. IF A SIMILAR TYPE AWARD WERE CREATED FOR THE EDUCATION FIELD, FOR EXAMPLE, OUR NATION-WIDE EDUCATION SYSTEM WOULD IMPROVE IN PROPORTION TO THE PARTICIPATION. OF COURSE, THE CRITERIA WOULD CHANGE FROM THAT OF THE BALDRIGE AWARD.

3. KEEP THE WINNING CRITERIA TOUGH AND ASSURE CHEATING IS NOT POSSIBLE. (ONE OF OUR QUALITY TRAINERS RECENTLY RETURNED FROM JAPAN HEARING FROM OUR JAPANESE EMPLOYEES THAT THE DEMING PRIZE HAS LOST SOME CREDIBILITY BECAUSE SOME COMPANIES HAVE FOUND WAYS TO CHEAT.

4. CONSIDER THESE FEATURES OF THE DEMING PRIZE.

A. HOLD A RE-EXAMINATION AFTER SIX MONTHS FOR THOSE BUSINESSES WHICH MISSED WINNING BY 50 OR FEWER POINTS AND AWARD THEM IF THEY'VE CORRECTED THEIR SHORTCOMINGS. IF A BUSINESS HAS FALLEN JUST SHORT OF MEETING THE CRITERIA FOR WINNING THE AWARD, ENCOURAGE THEM TO CONTINUE THOSE LAST FEW STEPS IN A TIMELY FASHION INSTEAD OF PUTTING THEM THROUGH THE ENTIRE RIGOROUS PROCESS AGAIN. IT'S EXTREMELY TIME-CONSUMING AND EXPENSIVE TO GO THROUGH AND ENTIRE RE-APPLICATION IF ONLY ONE OR TWO SUB-SECTIONS ARE WEAK.

B. INCREASE THE POTENTIAL NUMBER OF WINNERS PROPORTIONATELY TO THE INCREASE IN APPLICATIONS - OR ALLOW ANYONE WITH OVER 900 POINTS TO WIN THE AWARD, NO MATTER HOW MANY QUALIFY. SIX WINNERS SEEMS TO BE PLENTY RIGHT NOW. HOWEVER, IF THE APPLICATIONS START NUMBERING IN THE HUNDREDS, AND SEVERAL HAVE OUTSTANDING SCORES (ABOVE 900 OR 950 E.G.), KEEPING THE NUMBER AT SIX COULD THEORETICALLY RESULT IN A COMPANY SCORING HIGH TWENTY YEARS RUNNING WITHOUT WINNING. IN OTHER WORDS THE AWARD, AT ONLY SIX, COULD DISCOURAGE COMPANIES FROM APPLYING. WHEREAS, IF A COMPANY IS OUTSTANDING, A QUICK RECOGNITION (THE YEAR THEY'RE READY) SHOULD ENCOURAGE THEM TO NEW HEIGHTS.

C. CREATE A HIGHER AWARD FOR WHICH THOSE WHO HAVE WON THE BALDRIGE AWARD CAN COMPETE. (THE JAPANESE HAVE THE QUALITY CONTROL PRIZE TO SUPPLEMENT THE DEMING PRIZE). FOR EXAMPLE, WHY NOT ENCOURAGE MOTOROLA TO GO FOR NINE SIGMA. I'M SURE THE JAPANESE AREN'T GOING TO STOP AT SIX SIGMA. LET'S ENCOURAGE STEADY PROGRESS INSTEAD OF A PLATEAU AT LESS THAN PERFECTION.

THESE ARE A FEW THOUGHTS THAT OCCURRED TO US WHILE STUDYING THE BALDRIGE AND DEMING AWARD SYSTEMS. OVERALL WE BELIEVE THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD WILL DO AS MUCH, IF NOT MORE, FOR THE UNITED STATES THAN THE DEMING PRIZE HAS DONE FOR JAPAN.

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THE FEDERAL EXPRESS VIEW OF QUALITY

Thomas R. Oliver
Senior Vice President-
Sales and Customer Service
Federal Express Corporation
Memphis, Tennessee

Federal Express strongly supports the concept of the Malcolm Baldrige National Quality Award. The only problem is that it doesn't get nearly enough of the attention and recognition it needs.

In some ways that is because management in the United States is still trying to figure out what this Quality thing is all about, and the media obviously don't care. I'm not surprised. Our country's knowledge level is like the difference between my twelve-year-old son who's learning how to ballroom dance, and Patrick Swayze. Most corporate executives are struggling with the mechanics, and haven't gotten to the art. A lot of others have just given up, saying they don't have the time to fool with trying to get their subordinate managers to really understand and produce some results.

Let me explain why that is the case:

- When I graduated from the Wharton School in 1963, the Quality issue was not even taught. The Statistics Department had all the formulas, of course, but Quality as a fundamental element of the process of managing a company was not included in a single course I took.

- When I got my management training at American Airlines, and my on-the-job follow up, Quality Control was a tool, not a management process for everyone to join. And American, by the way, was the most advanced transportation company in the industry on this subject back in those days. But a Quality Process that involved all the employees was not seen as the unifying force to all the company's goals.

- Even now, I am exposed to precious little publicity on the Quality issue in the United States, other than a select amount of writing in the business press and the Ford Motor Company's commercials. We don't celebrate the winners and how they did it.

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The point is, because management training and management experience over the last three decades has not been squarely focused on Quality, a large percentage top-level U.S. managers cannot, in the main, even define it properly. They don't have an instinctive feel for the importance of all the elements and the power that is generated when they are used together in a fully coordinated Quality culture. In turn, these top officers are not passing these concepts down solidly to the lower levels in their own management teams.

This lack of experience, I believe, is also common to most educational and political leaders. That is why I so totally applaud your Subcommittee's efforts to develop the facts and get our Government policy really energized in this area.

Quality Is Too Powerful To Be Left to Chance

Let me make a comparison. It probably sounds like it cannot be true, but it is. If we could get senior business executives, educators and government policy makers to understand this point, we could substantially alter our private sector's ability to compete in the global market place. The point is this:

> Quality is to economic success as the nuclear reaction process is to energy production:
>
> The output is wildly disproportionate to the input once it builds to a chain reaction.

The reason this is true is that Quality engages the full mental energies of a company's entire workforce. It breaks the mold that says that management's job is to direct the work, and the employees' jobs are to do the manual labor. The Quality Process is based on the principle that if management will just involve everyone in the effort, that their first-level people can and will solve the business problems. In fact, they will do it far better than the managers can themselves by listening to their own opinions or sitting in their own offices.

Quality in the Service Industry

I understand that one of the issues you are examining is why there are no winners in service. The only light I can shed on this is that the processes of producing service are incredibly complex, and incredibly difficult to measure compared to a manufacturing process. If I drill holes all day, at the end of the day I can check the holes. When I

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deliver packages, its tough to measure my hustle, my friendliness, and my personal responsiveness to a dozen expectations of each customer.

Further, no one big action or program will fix the systems and human performance issues with which service companies must deal. Its like there are a "thousand points of darkness," to coin a phrase, where things can go wrong. How can you fix them all, every day, and keep them fixed?

The underlying difficulty services have is the lack of management education and management experience with Quality Process Success Stories in the service industry. There is no role model. This in turn means that we lack the necessary corporate cultures in large service organizations to really support and deliver a true Quality Process. But don't change your standards just to get a winner. What we need is real success, and examples for what can be done through hard work on a self-sustaining Quality Improvement Process.

At Federal Express, we are just a year and a half into institutionalizing our formalized Quality Improvement effort. It is a tough job with all the distractions and budget pressures of a high-pressure, price-competitive business. But it can be done, and we will. Next year, we intend to be competing vigorously for the Baldrige Award.

The Goal of Zero Errors in Everything

Quality is a frame of mind. It leads us to say that out of 1.1 million individual packages travelling in the Federal Express system tonight, that not a single one of them should be late or damaged or lost. That not a single customer question should not be answered immediately and correctly. That not a single customer should send his bill back to have it corrected, and that not a single customer should hang up the phone because we don't answer quickly enough. It's a tough set of standards.

The fact is, we had to change our basic corporate service measurement system at Federal Express this year to utilize a Quality-based analytical structure. We had to switch to the concept of Zero Errors rather than the percentage we got right. It is now so exacting and rigorous that our team faces the potential of Fifty Million different service failure points per day. Fifty Million chances to fail every day!

Our actual failure ratio, by the way, is less than 3/10ths of 1 percent on that exhausting basis, and we are very dissatisfied with it.

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Such a huge base of measurement amplifies every service item that does not meet our standards so that it can show up in a significant way to both employees and managment alike. The result of this process this year has been so powerful that although we have carried 20% more packages in our current fiscal year, we have generated 15% fewer absolute failure points than we did in the previous year. That's a 35% improvement in a service that most people thought was pretty good already, and in just one year.

The Search for Causes Rather than Blame

The Quality frame of mind leads one to search for the real root causes of errors in the system, rather than to place blame for poor performance. Most of such blame, by the way, is placed on the shoulders of the first-line employee, which is why managements and workforces get to have such an antagonistic relationship. The spectre of angry airline employees picketing every day on television is simply the most visible expression of a phenomenon that is latent in every company that does not live and breathe a Quality Process.

At Federal Express, each year we conduct a survey involving every single employee called "SFA", "Survey-Feedback-Action." SFA measures our employees' frame of mind about management leadership, satisfaction with pay and benefits, feelings of fairness, whether we are doing a good job for the customer, and a host of other items. As the base of employees has grown from 30,000 to 45,000 to 70,000, it has been harder and harder to change some of the basic indices we get out of this survey, like our "Management Leadership Index." At best they move upward by a full percentage point. 70,000 people is a lot of people to make happier at one time.

This year, however, our Quality Process effort has given much more ownership of the business issues to our front line people, and has let them really contribute to the solutions of a thousand little and not so little problems. The result is that our SFA results have gone up by five full percentage points. It is the largest jump in the ten year history of this survey. And we aren't even doing this really right in many areas of the company yet, and aren't doing it enough in any area of the company. Yet the people have felt a major difference in their involvement, and they like it a lot.

You Get Exactly What You Reward

The Quality frame of mind concentrates on rewards for good performance, and spreads the recognition into every nook and cranny of the organization. Our quality action teams put first-line couriers who

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deliver packages in Buffalo and Cincinnati into work sessions with Senior Vice Presidents, and rewards performers who execute test solutions successfully with letters of commendation and awards we call "Bravo Zulus" (which means "well done," if you're not a Marine or a Navy man), because recognition makes them all feel part of the corporate success.

Management gets rewarded, too. Our annual bonus program doesn't just give a little extra for Quality. Its all or nothing. If we fail to meet our corporate goal for improved Quality, we all get nothing at the end of the year. Since this bonus is 35% of my total compensation, I give it a lot of attention. And if we beat the goal by 10%, my bonus point value goes up by 8%.

Our customers in turn reward us: Quality means continued business growth and lots of praise for our people over jobs well done. Customers also give us the financial stability to aggressively plan for the future. Such success lets us undertake billion dollar investments in making FedEx much more competitive in the International Transportation market through steps like our merger with Flying Tiger Line. This investment, in turn, will greatly improve the services offered to U.S. companies shipping both in and out of the United States. And, frankly, it will also keep some of the money going out of the country to foreign airlines right here in the United States for a change. All this is made possible through Quality success.

The Baldrige Award

The Baldrige Award itself is an excellent vehicle to help propel American companies toward Quality, especially companies like our own who are just becoming aware of the power of Quality and are trying to make it happen.

The real prize, however, is probably the internal progress the award promotes in a company just by applying. Even if you don't win a physical award, you're enriched internally by the improvements that flow from trying to measure up to the Award's standards and measurement items.

Our brief comments on the application itself are that we believe that the seven items on the application are the right areas to emphasize. The only potential negative to a service company could be too heavy an emphasis on Statistical Process Control. While measurement, information and analysis are extremely important, we don't believe that most service companies need to get into the elaborate details of charting every event and using the statistics that work in manufacturing environments.

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In fact, we started our Quality effort over four years ago with a heavy emphasis to our executives on Statistical Process Control. It turned off many of them to the extent that our Quality Improvement Process lay pretty much dormant for two more years until somebody figured out that SPC was not at all the backbone of a successful Quality process.

For us, we now know that simple graphs and bars showing the trends in absolute numbers of failures get us moving on pareto diagrams of causes, which in turn tell us nearly everything we need to know. The key to Quality improvement is awareness of the issues and creativity in developing preventative solutions.

Program Recommendations

After a review of the 1989 program, we have a few recommendations:

1. Lets get some really visible rewards. Prestige is great, but money will get even the most skeptical corporate executive thinking. I think we should establish a 3% Corporate Income Tax credit for those companies that win the Baldridge Award, and 1% for the 'Quality Recognition Certificate' that I will describe later. Tying Quality performance to clear financial rewards will result in major increases in corporate efforts and visible successes, because Quality itself also leads directly to profit.

2. Establish a similar program for our nation's accredited colleges and universities. The school that teaches Quality best should get an Award right along with the companies.

3. Keep the winning criteria tough, and assure that cheating is not possible. I mention this latter point because one of our Quality trainers recently was told by some of our Japanese employees that the Deming prize has lost some credibility as some entrants have found ways to cheat.

4. Hold a re-examination after six months for those businesses which missed winning by 50 or fewer points and award them if they have corrected the shortcomings. They deserve the fruits.

5. Increase the potential number of winners proportionately to the increase in applications, or allow anyone over 900 points to win a 'Quality Recognition Certificate', so that many more of the successful companies find their efforts worthwhile. This, in turn, should be tied into the tax incentive program mentioned earlier, and would be also authorized for two years as a marketing logo for use in advertising.

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Government Must Create the Right Rewards

In closing, Just let me say that it bothers me immensely that the Japanese and others are not just beating our brains out in so many industries, they are now beginning to quietly buy the United States at very discounted prices. Yet there seems to be no strategy to deal with this issue.

The answer quite simply, is that we must learn to reward the right things. We in business must learn our trade a lot better so we can sell a lot more, and Quality is at the bottom of that. Our reward is improved customer satisfaction, employee satisfaction, and profitability.

But we aren't in the pit alone. Government needs to provide the right reward structure. It needs to stop providing tax incentives that encourage corporate raiding by letting the interest on those buy-outs be written off. It shouldn't let companies that spill millions of gallons of oil write off the costs. It should stop rewarding consumer consumption and mortgage debt.

Instead, we should have tax incentives that encourage personal savings and corporate investment. The Congress and the President should focus on effective rewards and recognition for every company that improves its Quality measureably and becomes more competitive in the International market place.

We need government and education to work closely with business on the right things, because businesses that produce more, invest more, and fight harder in the market place are the only solution to the economic dilemma our country faces in the 1990's and beyond. The way to do that is to create a reward system that truly incentivizes companies to do what public policy needs.

And the Number I step on your list should be making every one in America aware of and interested in the American Quality Process, for a change, and the Baldrige Award for the Best of the Best.

Thank you very much for your kind attention.

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Thomas R. Oliver is Senior Vice President-Sales and Customer Service for Federal Express Corporation, headquartered in Memphis, Tennessee. In this capacity, Oliver is responsible for all United States sales activities, as well as the customer automation, invoicing, electronic service support, and general customer service functions. Federal Express handles 250,000 customer telephone requests daily including pickups, information and other services.

Oliver joined the firm in 1978 as Vice President-Marketing and moved up to Senior Vice President-Marketing and Customer Service in 1980. In 1985, he took responsibility for the company's ZapMail service, ultimately making the recommendation to discontinue the service. Prior to that he held executive and managerial positions with Thomas Cook and American Airlines in sales, advertising, marketing planning and corporate development. He holds an Economics degree from the Wharton School of the University of Pennsylvania.

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Mr. BROWN. Thank you very much, Mr. West, and I'm hoping, of course, that you will enter the contest next year and that you will be the first to win the award in the services area.

Mr. WEST. We are already applying sir, just not for this year.

Mr. BROWN. Good.

You are not in my district, are you?

Mr. WEST. Not unless you are from Tennessee.

Mr. BROWN. I'm going to raise a point I made earlier about whether we are engaged in just another cycle here or there is something basically different and, if so, how we can continue it.

I recall 40 or 50 years ago when I was a student of management sciences we had a case study on the importance of employee participation. It was probably put out by the Harvard School, and I think it involved a major corporation, maybe Westinghouse or General Electric, I have forgotten which one. But they took a group of employees, and they measured their productivity, and then they improved the environmental conditions in the unit, and it led to improvement in output, and they kept improving it, the environmental conditions, and the output kept improving. And then they started reversing that and making the environmental conditions worse, and the output still kept improving, and that was a mystery to them until they finally figured out that the employees had been involved in all of this as a partnership, as a research kind of a thing, and that the key element was the involvement of the employees.

Now I cite that not for its great importance but for the fact that this was in a management case study 50 years ago. If we could figure out that management—that employee involvement meant improvement in productivity 50 years ago, how did we forget it so fast, and is the new recognition that has reflected it, as this being one of the criteria in the Baldrige Award, is this going to be forgotten, or is it going to continue? Do any of you remember the name of that—

Dr. HART. The Hawthorne Effect.

Mr. BROWN. The Hawthorne—

Dr. FEIGENBAUM. Western Electric.

Mr. BROWN. Western Electric, yes.

Mr. LUTHER. Let me comment on that, because we have a great advantage today that you probably didn't have at the time you were looking at it, and that is having a gun against our head by foreign competition—by all competition, and if we look at what we are going through, it is a world that is completely different than it was even five or six years ago, and in things as common as Corning ware, which has been on most tables in America, which we thought we owned in terms of a market. We found that the folks came in from offshore and simply took it away from us.

Well, desperation says you are going to use whatever tool you can to get back, and one of the tools we found was employee involvement. One of the factories we have just opened is completely team driven, has got one-third the management of our conventional factories; the people are paid based on training level and not on seniority; there is a special union agreement with those folks to get away from some of the conventional trouble we have had. You can't stop them from doing outstanding work for us, and I think

the combination of finding new ways to get employee involvement plus this very intense need, which we didn't have before, is what is going to make it succeed, I hope, today where it didn't in the past.

Mr. BROWN. Mr. West raised his hand first.

Mr. WEST. I think—and this is just my theory from a short 15-year experience in the business world—but I think the reason we lost what we had, which was a focus on employee involvement before, is because of the drive for profits, for finance. The natural tendency of managers even today in our company is, focus on the budget.

Fortunately for us, our chairman, Fred Smith, has the foresight to have a company motto which we in management are held to—and I have to stress management is the key here—of people, service, profit. We must do all three well, but if there is a tie for any reason, so to speak, people must come first, then the service, then the profit.

Mr. BROWN. Dr. Manley.

Dr. MANLEY. Having been in the very fortunate position to pick up a program after some homework was done by General Motors, PPG Industries, Westinghouse Electric Corporation, and Alcoa Corporation, working with the University of Pittsburgh and saying what is wrong with the engineering education and the business school education combined, that's spun off this new program that we have launched at the University of Pittsburgh, and I was very skeptical about the pressure to produce a course—a new course in quality, for example, that was mentioned, these kinds of things, by looking at it from the total perspective of an intra-disciplinary program which we have, which includes all fields of engineering. So we have industrial, mechanical, electrical on my faculty as well as the graduate school of business, and what we came up with was developing to complement what exists 15 brand new graduate level courses and a new master of science degree program.

Now through that, part of my testimony which I didn't cover, there are a lot of good things that people do, but it is not this total look; you have to have top management support; that has been said, that goes without saying, there is no question about that. But beyond that, it can be a fad unless you can implement and you can find out ways to measure. We have problems with our accounting systems, going with direct labor; we have now found ways to actually correct those problems, I mean actually accounting different ways, measuring different ways, using technology in different ways, and it is the combination of all of that can then institutionalize these changes, and that is what we are about there, is trying to find out how do you make this real and not let it just be a fad.

So what has been happening so far is just absolutely outstanding, putting quality on the map and foremost and to answer this threat of the competition, which is more than a threat—we were starting to lose it—and now I think we are coming back, and so that is my perspective on that.

Mr. BROWN. Yes. Well, I don't want to belabor that point. There are many other aspects, as you have all pointed out, to the total picture of quality control than employee involvement. But involvement, really, is, in the broadest sense, the key to a lot of this—the involvement of your customers, your top management, your suppli-

ers, as well as you implied, and you are suggesting now—one of you, at least, I think—that we have got to involve maybe our educational system in some constructive way.

Mr. Ritter.

Mr. RITTER. Thank you, Mr. Chairman.

The chairman just closed with a comment on involving the education system, and I've got a question for Dr. Hart and Dr. Manley. If, indeed, we are witnessing and participating in a third industrial revolution where it is the human resource revolution, and these ideas are so compelling as to drive companies from—and maybe all of you could maybe answer on this as well as just the educators—and the ideas are so compelling as to drive companies from having lost market share to regaining market share and being the kind of sine qua non for global competitiveness, why is it that the educational establishment is responding so slowly?

Why don't we go to Dr. Hart, and Dr. Manley, and then maybe Dr. Feigenbaum, and the others, if they want to comment.

Dr. HART. Well, what is the bottom line in an educational institution? Once a business school or an engineering school gets a student to matriculate, they take whatever courses they are given. They have no opportunity to shop while they are in college; in essence, they take the required courses, and the required courses are laid down by faculty who, in essence, aren't put to the market test of, if your material isn't what business needs today, you go out of business. That's a peculiarity of the educational system and, I think, can account in great measure for the lag effect with respect to getting relevant and getting current with what—

Mr. RITTER. In other words, faculty are put to a test but it is not the market test is the point that you are making.

Dr. HART. Yes. That's right.

Mr. RITTER. Publish or perish; get your research contracts and grants. But it would not be what you would define as a market test. Is that correct?

Dr. HART. That is correct, with respect to going out of business, if what you are teaching your students today isn't what business demands tomorrow, and when you aggregate that through all business schools, for example, you look at fairly homogeneous competitive offerings where faculty are traded around from school to school; there isn't nearly the kind of competition among schools that you would see between, for example, Federal Express and UPS in the overnight business.

One other point. This quality issue is certainly a difficult one for academia to get its arms around. It is not a simple topic; it's a difficult topic that can be attacked in many, many ways.

Mr. RITTER. It's a broad topic as opposed to a narrow topic, too, and the faculty are usually much more comfortable with the peak narrow fields of knowledge as opposed to the integrative—

Dr. HART. Precisely. Twenty-five/thirty years ago, as a discipline, as a subject, was in the same situation; companies were asking, "Gee, marketing, what is it? Do we hire a vice president?" Nobody was quite sure what it was, and it took 20, 25, 30 years for it to become an accepted part of business curricula.

Mr. RITTER. I think if we wait 20, 25 years, the ball game is going to be over.

Dr. Manley, do you want to add anything?

Dr. MANLEY. I have quite a bit of industry pressure on me personally to make sure that we do respond. The model we have at Pitt is an industry/university partnership that I have an industry advisory board of corporations, of which Westinghouse is one, who was here testifying, and in addition to that, they do not tell us, the university model, they cannot dictate what is in the course or exactly what it can be, but they can tell us whether or not we are doing the right thing.

So then I have my faculty meeting following an industry meeting, and I say industry wants us to be teaching this or modifying a course this way, and they all say, "No, because"—and then—so I've become the shuttle diplomacy between these two groups, and what we are doing is jointly shaping the curriculum, shaping the courses, and that is coupled with an industry internship where our students then go for four months and working on a thesis level project in a company, actually working on the job.

So the combination of those things plus reporting to Westinghouse, you might here say—and John Maurous also gave us $1.4 million as the seed money to get this program going of the four companies. I report also to a Westinghouse committee who is looking at how I am spending the money on this program, and I have—

Mr. RITTER. So there is a bit of a market test out there.

Dr. MANLEY. Absolutely. And so I am being industry also in my background. I strongly feel the quid pro quo—

Mr. RITTER. How many programs are there out there like yours? How many programs are actively integrating? I looked at your testimony, although I wasn't here for it. How many programs do we have in this country that are grabbing this bull by the horns, so to speak, educationally?

Dr. MANLEY. I would say there are a lot that are labeled like this, but I'd say there's about six or seven major programs at this point that are like this.

Mr. RITTER. That are also relatively recent in their evolution?

Dr. MANLEY. Right. And a large number of those, or four or five—I can't remember what the exact number is—were spun off by an IBM grant back about three or four years ago.

Mr. RITTER. You get industry driving as opposed to the government.

Dr. MANLEY. Yes. These are industry-driven programs.

Mr. RITTER. Dr. Feigenbaum, I just want to let you know that I am honored to be in your presence as one of the great revolutionaries of our time, bringing quality to America and the world.

Dr. FEIGENBAUM. You are very kind.

Mr. RITTER. I want to thank you personally.

But do you want to comment on this educational dimension?

Dr. FEIGENBAUM. It is one of the great problems that I have faced for many years, and a part of the issue, I think, is that if you take what has been discussed in this room today and put it in the context of graduate schools of business, it tends to obsolete the basic foundation on which many long-tenured faculty leaders have built their careers, and that is a tough thing to have to face.

The basic premise up through the 1970's and perhaps the early 1980's—and it worked—was, make them quicker and cheaper; sell

them hard; finance them cleverly; and a great proportion of business school faculties developed their specialties in those terms.

What we are saying here today is that making it better means quicker and cheaper, and that is quite a different teaching approach.

Mr. RITTER. And yet business schools and engineering schools are really tenured up; the number of faculty that can be added in this day and age is quite a marginal number, and I guess attrition is probably the only real hope that one has.

Dr. FEIGENBAUM. I think, for instance, when I ask the question in graduate business schools, how many full professors of quality are there among the many professors of marketing and professors of finance and professors of production? the reaction I get is that I must somehow have gone in the direction of being overly narrow, because the very notion of having a full professor quality offends these gentlemen.

Mr. RITTER. Dr. Hart, the Harvard Business School has had faculty who have recognized this in the last five, six, seven, eight years. I mean you read papers of people calling attention to this as the secret weapon for global competitiveness. Hasn't Harvard had a chance to really go at this thing in a more effective way?

Dr. HART. Sure. There's been a lot of attention placed on what should we be doing with regard to teaching various aspects of quality, and there is a fairly large component in the first year production course that addresses quality in a broad sense. There are components in second year elective courses that focus on quality in a broad sense.

Part of the issue is one of competing demands. Students today—ethics is something that we have devoted a lot of attention to, and there is, I believe it is a ten-session course that is now given to the first year student. So there is an opportunity cost; for everything that is added, something else must be subtracted, and it is difficult to figure out exactly what gets knocked off when something else gets added in.

For example, the AACSB is today not overly concerned about requiring courses on quality in business schools because, from their perspective, international business is at the top of their list, and to them quality—international collapsing boundaries. And so there is a question of priorities.

Mr. RITTER. In other words, if we don't have it, somebody else will, and it doesn't matter who owns it. Is that it?

Dr. HART. Say that again.

Mr. RITTER. You said that international business was a hot topic, and I responded, is the faculty of the opinion that if we don't have it somebody else will; therefore, it doesn't have to be owned by Americans? I mean what should students be taught? I don't know. If you are thinking about international business in my book and you want to compete all over the world and you don't do quality, you might as well pack up and go home or buy into a Japanese company, you know.

Dr. HART. Well, that's one view, and I certainly subscribe to it, but others from the finance department would say, "What does international business mean in terms of finance? My God, a company can go bankrupt if you don't understand foreign exchange fluc-

tuations." So there are competing demands, and I think the fundamental point is that the noise level regarding quality is certainly on an upward trend, and I see, and I think the entire committee sees, big things happening, and this award is certainly quite a springboard for it.

Mr. RITTER. Dave Luther, are you getting enough people coming into Corning that can really do this quality business?

Mr. LUTHER. Enough people to look at what we are doing?

Mr. RITTER. Well, who are capable of handling what you are doing, from workers on up—blue-collar workers on up, white-collar workers.

Mr. LUTHER. In terms of the blue-collar workers, we are doing okay. We don't have quite the problem you have in the urban areas. But we are spending a great deal of money on training them as well. This 5 percent of time worked—that is 100 hours, I mentioned earlier—is a pretty significant contribution towards enabling them. But we are doing that world-wide, it's just not—it's just not in Corning.

If you look at the people we are getting from school, from the graduate schools, we are getting a different problem on our hands, and I had a personal experience of getting a bunch of foremen in a room, and the foremen, first line supervision, are reputed to have the toughest role in quality, and I had some very senior people that had been around for 30 years, and I had some of the most recent graduates from Harvard and from MIT, and I thought the reaction I was going to get from Harvard was, "We understand quality, and it is what we ought to be doing," and I thought the reaction from the old line foremen were, "This is the craziest idea I have ever seen." It was just the reverse; it was just the reverse.

Let me just finish that one thought. The foremen said, "Twenty years ago, I used to hire my people, I used to train them, I used to decide what went in and what went out, I used to run my shop, and then all these great schemes came along like zero based budgeting, matrix management, staff help, and I lost it; quality gave it back."

I asked the new people, I said, "Well, why are you having a problem?" They said, "We came in here to give orders and take names and move the ware." Well, the last group were 180 degrees away from what we were trying to do, and we had to do a major—

Mr. RITTER. All right. One last question. Given the snail's pace of the establishment in the educational realm, is there a role—a Congressional role to accelerate this process and to juice it up or—you know, faculty seem to often pay attention to dollar signs; they go where the funds are. Should we be creating something here that—in a way that—you know, the last thing we want to do is have the government's hand come in and define the system, because I fear that part of the response of academe getting to the point where it is today is a response to a government set of initiatives for engineering science and engineering research and a whole host of careers that really had a great distance between them and markets, and products, and processes, and sales, and you know, doing business with the best.

So do you want to comment on what the possibilities might be coming out of Congress? Dr. Feigenbaum, then Dr. Manley, and Dr. Hart.

Dr. FEIGENBAUM. I think that one of the great contributions that could be made in one form or another would be encouraging recognition that quality today is a body of knowledge rather than a set of superficial slogans, one-day courses, or possibly two- or three-page "how to do" textbooks. I think the perception that it is that latter, it is a group of slogans and something that is secondary or tertiary, has been a great reason why in the educational community otherwise objective, well intentioned educators have chosen to overlook this field or to think of it as being a technician area of quality statistics and so forth.

If there could be focus on quality as an organized area of study, much broader than that of merely the mathematical location, I think that could be a very significant offering in the right direction.

Mr. RITTER. Dr. Manley.

Dr. MANLEY. Yes, I would like to underscore that. I agree completely with that view. And the other thing that I've found that, in order to get grants, basically NSF grants and the standard scientific grants, it is mainly pushing back the state of art and knowledge in the traditional fields, and the structure of the agencies and everything are along those kinds of lines.

So if there is more support or recognition of interdisciplinary areas such as quality, that is one of those, as evidenced by—I mentioned in my testimony supporting these Department of Defense programs, for example, that are looking at that across the board. Then that gives a little more credibility for the faculty members to go out and apply and try to get and do research in those areas.

Now I am not sure whether it is going to help in young professors trying to get tenure. I have had great difficulty getting them to join this interdisciplinary curricula, but the more senior professors that are a little more stable, they are more willing to go along with that.

But more recognition, yes, that could help.

Mr. RITTER. This subcommittee and this chairman, I might add—Congressman Walgren—has been very interested and very supportive of doing whatever could be done—given our perspective, we can't do everything here—but to promote manufacturing and the substantive issues of manufacturing and to try to build more manufacturing into the federal support scheme as opposed to science and engineering science. So we will take your—both of your words to heart.

Dr. Hart.

Dr. HART. One comment pertaining to the importance of what you are doing with the Baldrige Award in NIST. I view that as a green light. I view the entire Baldrige Award operation as an opportunity to bring examiners, judges, quality professionals together who are all trained in the same language, the same methodology, and to the extent that funding is there for the organization that is responsible for administering this award to do such things as promote teaching material development that focuses attention and makes it easy to teach what this whole thing that is messy is all

about in a way that is exciting, that is fun, I think that education—educators will pick right up on it just immediately, and there is no bureaucracy required to get that done through this department, and that is terrific.

Dr. FEIGENBAUM. Mr. Congressman, may I just offer another point to underwrite a point that I heard you make some minutes ago that science and research without the relevance to quality can tend to be abstract. I think that if, as part of this discussion we are having, recognition could be provided that quality is as much an area of importance in technology—for instance our semiconductor success—as research and development is, it could go a very long way in focusing the academic as well as the business community on what it is that really is involved here.

Mr. RITTER. I don't know how we get that across. It is not an easy task. I mean when you look at the automobile industry and all of the technology that goes into it and all of the science that underpins that technology, it wasn't until the automobile industry got very serious about quality that we have seen a resurgence of the U.S. automobile industry. The fact was that in 1980 Ford was flat on its back and General Motors had the money, but Ford went to the quality solution, General Motors went to the robots, and look what happened. Of course, General Motors is spending a lot of time in the last several years on quality, and they are starting to turn their shop around.

But, you know, how you accelerate—I think our aim here with this committee is to do what we can to accelerate the onset of these principles with the full understanding that our competitor nations—it is not just Japan—the Asian Rim nations have modeled their systems after Japan, and, starting from scratch, they are doing some excellent work as well, and Europe—this thing is global. It is quite a challenge.

Mr. Luther.

Mr. LUTHER. Let me just make one comment, and the area that I see as a real area for opportunity has to do with small business. When I look at the people that I see that are involved in quality, they tend to be Fortune 200, Fortune 300, kinds of firms. In fact, a lot of them have been at it for some time.

The place we are having difficulty is with the small companies that are supplying us, and the comments that I hear, in spite of the outstanding contribution by Globe—the comments I hear from small business is, "I don't have the money, I don't have the time, I can't afford what the big businesses do."

Mr. RITTER. And yet the irony is that if they did this, it would actually—it is actually easier to do it in small companies.

Mr. LUTHER. Absolutely, but they don't know that.

Mr. RITTER. And maybe there is some opportunity to juice that system.

Mr. West.

Mr. WEST. I was just going to say briefly that what Dr. Manley discussed and I know what Harvard promotes is this partnership. That is a real key here. You can train all the college students you want to in quality. If they encounter management that doesn't believe in it, they are never going to be able to practice it. So the partnership area is very key.

I also would say that there are very few quality positions in the United States. In our company, there is basically one quality position, which is mine, and there are some sub-quality positions.

Our whole goal in quality is just to make a total cultural change so every person in the company is a quality expert and we don't need a person like myself to try to promote quality throughout the corporation. But until we are to that point, the real key here is, if you push too hard and get students all enthusiastic about quality and then they get into a company that doesn't breath it and live it, they are going to lose everything they learned.

Mr. WALGREN. Would the gentleman yield?

Mr. RITTER. Yes.

Mr. WALGREN. How do you try to sell that to the others in the corporation? What do you use as the reason for them to make that cultural change?

Mr. WEST. Well, we are going through that right now. I mean this—recently—our experience is, it is with small groups: Sort of light the fire, so to speak, with inspiration. We started with small groups. I said that the SPC killed ours for two years, our quality improvement process. The way we rekindled the fire was, small groups started doing it—

Mr. WALGREN. SPC was what? I'm sorry.

Mr. WEST. Statistical Process Control. I'm talking from a service standpoint now as opposed to manufacturing.

We got small groups, though, who really wanted to do this. Their successes inspired others, and it just was sort of a progressive inspiration, if you will.

Finally, we got to the point where our chairman and the other senior officers bought into it as we progressed, and then everything started cascading from top down. But ours was a bottom up movement first.

Mr. WALGREN. I see.

I thank the gentleman.

Mr. RITTER. One last question. Do we need a quality university of America, given some of the slowness of all this? Do we need something that will handle the "If I had my druthers, what would I do to create a cadre of people who are disciples, and experts, and capable of—with the talent to convince management that this stuff is important," or can we handle it with the status quo educational system? I mean if you had your druthers, would you want to put something on the map that led the way?

Dr. Feigenbaum.

Dr. FEIGENBAUM. Well, I would much prefer to see the Indian hand wrestling with the existing faculty community successful before we embark on the other route, although I wouldn't rule it out.

I question—and I would yield to my associates here who are actually in the academic community—as to how much support they have really received operationally from many of the rest of us in making some of the points to their associates that we have discussed here as opposed to making quality again simply an occasional course or an occasional offering.

I think that some of the same rather effective activities that have been taking place within companies to promote quality

awareness and what it tends to mean perhaps have not yet taken place on the university campuses, and I think that taking such a step, at least as a precondition to moving in a greater direction, might very well be warranted.

I see very little evidence of the kind of Baldrige effort taking place in industry taking place on the campuses.

Mr. RITTER. Well, the organizational structure, I would think, mitigates against that, and it would be one rare university that put itself through a total quality management effort.

Dr. MANLEY. I can say what we have physically done in the year and a half at Pitt. It started out with a course in correctly—that you said, in industrial engineering. We had a course, the obvious course, in quality control. That has been changed to a course in quality management that includes engineering management within the School of Engineering in addition to the quality control but a lot more depth and a better course, which is going—it is completely revised, and it is all new.

The Graduate School of Business now has a brand new course developed that is comparing the various techniques, like Deming, Juran, et cetera—to find out exactly how those work. And then our theme, as I stated before in my testimony, is to make quality a continuous cultural theme through all the rest of the courses. So I teach a course in issues in manufacturing systems engineering. I devote three nights to quality of a 15-week course. I mean that is given as a major element of that. So it comes into modules and safety engineering. We have a variety of courses.

So that is how it is being introduced, and it started with very, very little a year and a half ago and now a lot. But that is because of industry pressure, basically, from my advisory committee getting us aware of that, educating the faculty into the necessity, which then is translated back into the curricula itself.

Mr. RITTER. Dave, do we need a national quality institute that teaches at five different levels, or—you know?

Mr. LUTHER. My guess is probably not. The marketplace is doing a lot of it. The marketplace is going to drive out the people that aren't going to be able to compete. The ones that are astute are going to do it themselves, and it strikes me that there are such differences in different parts of industry that you are better served having them do their own thing than it is to have some generic solution made available to all.

Mr. RITTER. Well, I have taken far, far longer than I should have, and I thank you for your indulgence, Mr. Chairman, but this is an issue, as you know, that is close to my heart.

Mr. WALGREN. I want to salute the intensity and the focus that you have given to quality on this committee, and you have been the source of much of the direction that we have taken, and I am pleased you were able to spend the time with us today, and it obviously reflects your interest in the subject, and in contrast to the inability that I have had to spend the time with the committee today, and I apologize for that but do want to emphasize how important I think it is for our committee to be gathering the kinds of views and be a part of the forum in which these views are expressed, and I hope that people who are interested in this area and

have responsibility in this area will be able to take into account the emphasis that you have given to it.

Mr. RITTER. If the chairman would yield, I want to once again commend him, because I think this is a quiet revolution, and it is, I think, a measure of the metal of the chairman that he is willing to take on this most important subject and really lead the Congress; that is what is happening.

If you go and ask Members of Congress what they know about quality, you know, they will probably give you a very traditional decision—answer about, you know, their Rolex watch or something like that. So it is important that this subcommittee and this full committee really take the lead, and I am grateful to our chairman for doing that.

Mr. WALGREN. Well, I certainly appreciate that, and we look forward to continuing our interest in this area in hopes of making a contribution.

I want to thank all of you for being a resource to us. You have been a good panel, and it has been good testimony today, and so we look forward to working with it from here. Thank you all very much.

[Whereupon, at 3:30 p.m., the Subcommittee was adjourned.]

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